





Harry Hoagström









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FIG. 1. *Epomophorus anurus* HEUGLIN.

FIG. 3. *Eidolon helvum* KERR.

FIG. 2. *Epomops franqueti* TOMES.

FIG. 4. *Hypsignathus monstrosus* H. ALLEN.

ALL MALES:  $\frac{3}{4}$  NATURAL SIZE



737  
CSA427  
1917  
MAMM

59.9.4 (67.5)

**Article XVIII.—THE AMERICAN MUSEUM CONGO EXPEDITION COLLECTION OF BATS.<sup>1</sup>**

BY J. A. ALLEN, HERBERT LANG AND JAMES P. CHAPIN.

PLATES XLIV-LV, 26 TEXT FIGURES, AND MAP.

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PART I. SYSTEMATIC LIST.

BY J. A. ALLEN.

The collection of Bats obtained by the American Museum Congo Expedition consists of 794 specimens, representing 68 forms (65 species and 3 additional subspecies). About 250 specimens are preserved in alcohol; the remainder are well prepared skins with skulls, full field data, and measurements taken from the specimens before skinning. The percentage of missing or defective skulls is small — much less than in any other large collection of mammals it has ever been my privilege to study. This material is thus in the highest degree satisfactory for research. Its determination, however, has been difficult and laborious, due to the impossibility of making direct comparison of the specimens with types or other authentic material in the museums of Europe, owing to the present disturbed international relations.

The American Museum of Natural History had practically no African material representing this order of mammals previous to the reception of the Lang-Chapin Congo collection, and the other museums of this country have comparatively little. This, however, has been kindly placed at my disposal and has proved of great service. I am indebted to Samuel Henshaw, Director, and to Dr. G. M. Allen, curator of mammals, of the Museum of Comparative Zoölogy at Harvard University, for the loan of 23 specimens from the Blue Nile region and from British East Africa; and to the au-

<sup>1</sup> Scientific Results of the Congo Expedition. Mammalogy, No. 2.



thorities of the United States National Museum, through the kindness of Mr. Gerrit S. Miller, Jr., curator of mammals, for the loan of 77 specimens of African Molossidae and Vespertilionidae. Although very few of the 30 species represented in these loans were contained in the Lang and Chapin collection, they were nevertheless of much assistance in working out the species in the latter. It was therefore necessary to proceed with the work almost exclusively from the basis of the literature.

Andersen's work on the Megachiroptera<sup>1</sup> has rendered comparatively easy the determination of the specimens of this suborder; Miller's 'The Families and Genera of Bats'<sup>2</sup> has been invaluable as a general guide to the minor groups. Aside from a few papers reviewing special groups of species, the literature is widely scattered, the latest general revision being Dobson's 'Catalogue of Chiroptera,'<sup>3</sup> published nearly thirty years ago.

The bat fauna of the Belgian Congo is apparently poorly represented in museums, judging from the infrequency of references to specimens from this region in literature.<sup>4</sup> A considerable number of species, however, have been described from bordering districts which should naturally be expected to occur in Belgian Congo, but they are for the most part un-

<sup>1</sup> Andersen, Knud. Catalogue of the Chiroptera in the Collection of the British Museum. Second Edition, Vol. I, Megachiroptera. 1912. 8vo, pp. ci + 854, text figs. 1-79.

<sup>2</sup> Miller, Gerrit S., Jr. The Families and Genera of Bats. Bulletin 57, United States National Museum, 1907. 8vo, pp. xxvii + 282, pll. i-xiv, text figs. 1-49.

<sup>3</sup> Dobson, George Edward. Catalogue of the Chiroptera in the Collection of the British Museum. 1878. 8vo, pp. xliii + 567, pll. 30.

<sup>4</sup> The following papers relating to the mammal fauna of the Congo region list a few species of bats, as follows:

DOLLMAN, GUY. Notes on Mammals collected by Dr. Christy in the Congo and by Dr. Bayer in Uganda and British East Africa. Rev. Zoolog. Africaine, IV, fasc. 1, pp. 75-90, July, 1914.

This paper includes 9 species of Chiroptera, 6 of which are from the Congo, as follows:

*Epomops franqueti* (Tomes). Stanleyville, 5; Avakubi, 2; Mambaka, 2.

*Hipposideros cyclops* (Temm.). Avakubi, 2.

*Hipposideros caffer* (Sund.). Avakubi, 1.

*Nycteris hispida* (Schreb.). Avakubi, 2; Funda, 1; Makala, 1.

*Kerivoula cuprosa* Thomas. Avakubi, 2 ad. and 2 juv.

*Taphozous mauritanus* E. Geoffroy. Stanleyville, 1.

THOMAS, OLDFIELD. List of Mammals (exclusive of Ungulata) collected on the Upper Congo by Dr. Christy for the Congo Museum, Tervueren. Ann. and Mag. Nat. Hist. (8), XVI, pp. 465-481, December, 1915.

Lists 8 species of Chiroptera, as follows:

*Eidolon helvum* (Kerr). Medje, 1.

*Epomops franqueti franqueti* (Tomes). Medje, 1; Ituri, 1.

*Hipposideros caffer* (Sundevall). Poko, Welle district, 10.

*Nycteris grandis* Peters. Poko, 1.

*Nycteris hispida* (Schreber). Medje, 1; Poko, 3.

*Scotophilus nux* Thomas. Medje, 2.

*Otomops martiensseni* (Matschie). Poko, 1.

*Myopterus albalus* sp. nov. Welle River, 1 (collected by M. Hutereau).

THOMAS, OLDFIELD. On small Mammals obtained in Sankuru, South Congo, by Mr. H. Wilson. Ann. and Mag. Nat. Hist. (8), XVIII, pp. 234-239, August, 1916.

Lists 19 species, of which 2 are bats, as follows:

*Eidolon helvum* (Kerr). Inkongo, 2.

*Saccolaimus peli* (Temm.). Inkongo, 1.



represented in the present material. A number of them are based apparently on single specimens, sometimes alcoholic, and the descriptions are consequently not entirely satisfactory as an adequate basis for critical comparison. It is not therefore surprising that the present large amount of material should include a considerable number of new forms, some of them of obvious distinctness from any previously recorded, while others seem nearly related to forms described from contiguous countries, with which direct comparison has in most cases been impossible. In such instances it has seemed preferable, in view of the geographical conditions and the apparent discrepancy in characters involved, to give names to such forms than to merge them with forms already described to which they seem not properly referable. Of the 68 forms here recorded, 29 are described as new. Two superspecific groups are also characterized, one of which (*Allomops*, p. 470) is closely related to *Mops*, the other *Lophomops*, p. 460) to *Chærophon*.

In working up this intensely interesting collection I have been greatly indebted to Mr. Herbert Lang, the leader and organizer of the Expedition,

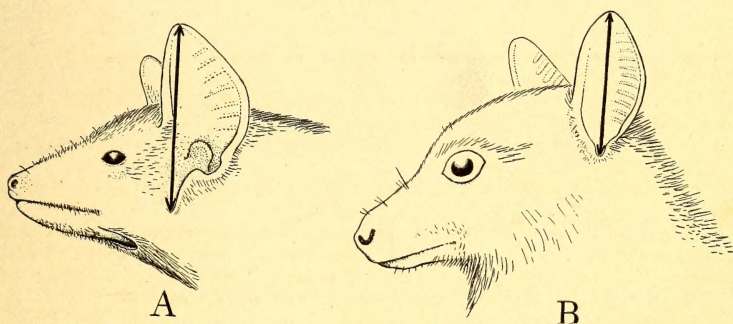


Fig. 1. Outline drawings showing how the ear was measured by the collectors. A. *Saccolaimus peli* ( $\frac{1}{2}$ ); B. *Eidolon helvum* ( $\frac{2}{3}$ ).

and to Mr. James P. Chapin, his able and enthusiastic co-worker during the six years of their continuous, exceptionally successful and intelligent field work in Equatorial Africa for invaluable information regarding the environmental conditions and relationships of the localities at which the present material was collected. Their contribution of field notes and illustrations to the present paper I am sure will be recognized as the most important contribution ever made to the life-history of the Chiroptera of Africa. The text illustrations of the cranial and external characters of certain species are contributed by Mr. Chapin, except those of the skull of *Kerivoula cuprosa*, which were made by E. S. Christman. The plates are from drawings by Mr. Chapin and from field photographs by Mr. Lang.



For convenience of reference, in respect to geographical data, two tabular lists follow, giving (1) a list of the species, the localities at which they were taken, and the number of specimens of each obtained; (2) a list of the localities, with the names of the species and the number of specimens of each species obtained at each.

The length of the ear, given under the heading 'collectors' measurements' in the present paper, was uniformly taken as indicated in the accompanying outline drawings (Fig. 1); namely, from the lowest point of the ear in front of the antitragus to the tip, instead of from the notch behind the antitragus, as this measurement is usually taken. The method employed in the present collection thus gives a greater length for the ear than by the usual method of measuring the ear from the 'notch,' the difference in some species being very considerable and without this explanation might lead to confusion.

The length of the foot, as given in this paper, always includes the claws.

All measurements are in millimeters.

1. *List of Species and Subspecies, giving the Localities at which they were taken and the Number of Specimens from each Locality.*

Species	Localities	Totals of Specimens
PTEROPODIDÆ.		
1. <i>Eidolon helvum</i> (Kerr).	Avakubi 50, Medje 4	54
2. <i>Epomops franqueti franqueti</i> (Tomes).	Avakubi 6, Medje 12, Leopoldville 1, Niapu 1, Niangara 1, Stanleyville 2, Vankerkhovenville 1	24
3. <i>Hypsignathus monstrosus</i> H. Allen.	Avakubi 19, Stanleyville 4, Bafwabaka 6, Penge 1	30
4. <i>Epomophorus anurus</i> Heuglin.	Faradje 24	24
5. " <i>wahlbergi haldemani</i> (Hallowell).	Cape Lopez 1	1
6. <i>Micropteropus pusillus</i> (Peters).	Niangara 1	1
7. <i>Casinyceteris argynnis</i> (Thomas).	Medje 1	1
8. <i>Myonycteris wroughtoni</i> Andersen.	Medje 4	4
EMBALLONURIDÆ.		
9. <i>Taphozous mauritanus</i> Geoffroy.	Niangara 2, Faradje 41, Avakubi 3, Garamba 1, Yakuluku 1	48
10. " <i>sudani</i> Thomas.	Dungu 11	11
11. <i>Saccolaimus peli</i> (Temminck).	Avakubi 4, Ngayu 3, Bafwabaka 1, Medje 4, Niangara 4, Rungu 1	17
12. <i>Colëura gallarum nilosa</i> Thomas.	Aba 9	9

Species	Localities	Totals o Specimen
NYCTERIDÆ.		
13. <i>Nycteris hispida</i> Schreber.	Boma 3, Stanleyville 4, Avakubi 3, Medje 1	11
14. " <i>pallida</i> sp. nov.	Faradje 8, Vankerckhoven-ville 4	12
15. " <i>avakubia</i> sp. nov.	Avakubi 1	1
16. " <i>arge</i> (Thomas).	Avakubi 8, Medje 2, Niangara 2	12
17. " <i>major</i> (Andersen).	Garamba 1, Faradje 1	2
MEGADERMIDÆ.		
18. <i>Lavia frons affinis</i> Andersen and Wroughton.	Faradje 25	25
RHINOLOPHIDÆ.		
19. <i>Rhinolophus hildebrandti eloquens</i> Andersen.	Aba 3	3
20. <i>Rhinolophus abæ</i> sp. nov.	Aba 10	10
21. " <i>axillaris</i> sp. nov.	Aba 5	5
22. <i>Hipposideros caffer centralis</i> Andersen.	Leopoldville 1, Avakubi 14, Medje 12, Niangara 2, Faradje 4, Poko 3, Aba 3	39
23. " <i>caffer niapu</i> subsp. nov.	Niapu 10	10
24. " <i>abæ</i> sp. nov.	Aba 35	35
25. " <i>nanus</i> sp. nov.	Faradje 1	1
26. " <i>langi</i> sp. nov.	Avakubi 4, Niangara 2, Medje 7, Niapu 1	14
27. " <i>gigas niangaræ</i> subsp. n.	Niangara 1	1
VESPERTILIONIDÆ.		
28. <i>Myotis bocagii bocagii</i> (Peters).	Leopoldville 1	1
29. " " <i>cupreolus</i> (Thomas).	Bafwabaka 11, Medje 3	14
30. " " <i>hildegardæ</i> (Thomas).	Aba 11, Faradje 2	13
31. <i>Pipistrellus nanus</i> (Peters).	Stanleyville 6, Risimu 1, Ngayu 4, Bafwabaka 30, Gamangui 1, Medje 6, Niangara 9, Faradje 7, Yakuluku 1, Poko 1, Garamba 1	67
32. " <i>abaensis</i> sp. nov.	Aba 3	3
33. " <i>musculus</i> Thomas.	Avakubi 1	1
34. <i>Scotozous rüppelii</i> (Fischer).	Poko 1	1
35. <i>Eptesicus tenuipinnis</i> (Peters).	Ngayu 7	7
36. " <i>ater</i> sp. nov.	Faradje 2, Niangara 2	4

	Species	Localities	Totals of Specimens
37.	<i>Eptesicus faradjius</i> sp. nov.	Faradje 14, Niangara 10	24
38.	" <i>minutus minutus</i> (Temminck).	Niangara 1, Isiro 1	2
39.	" <i>garambæ</i> sp. nov.	Garamba 1	1
40.	<i>Mimetillus moloneyi</i> (Thomas).	Stanleyville 1, Medje 2, Avakubi 1	4
41.	<i>Scoteinus schlieffenii</i> (Peters).	Niangara 1	1
42.	<i>Pachyotus altilis</i> (G. M. Allen).	Faradje 2.	2
43.	" <i>nigrita nux</i> (Thomas).	Medje 2	2
44.	<i>Glaucocycteris papilio</i> (Thomas).	Niangara 4, Faradje 13, Aba 3	20
45.	" <i>humeralis</i> sp. nov.	Medje 4, Avakubi 1	5
46.	" <i>alboguttatus</i> sp. n.	Medje 1	1
47.	<i>Miniopterus breyeri</i> vicinior subsp. nov.	Aba 17	17
48.	" <i>inflatus</i> Thomas.	Thysville 13	13
49.	<i>Kerivoula cuprosa</i> Thomas.	Medje 1, Akenge 2	3

## MOLOSSIDÆ.

50.	<i>Myopterus albatu</i> s (Thomas).	Niangara 7	7
51.	<i>Nyctinomus ansorgei</i> Thomas.	Faradje 26	26
52.	" <i>leonis</i> Thomas.	Panga 1, Medje 1	2
53.	" <i>cisturus</i> Thomas.	Niangara 1	1
54.	" <i>ochraceus</i> sp. nov.	Medje 22	22
55.	<i>Chærephon frater</i> sp. nov.	Malela 22	22
56.	" <i>russatus</i> sp. nov.	Medje 27	27
57.	" sp. indet.	Avakuba 1	1
58.	" ( <i>Lophomops</i> ) <i>chapini</i> sp. nov.	Faradje 2	2
59.	" " <i>cristatus</i> sp. nov.	Boma 4	4
60.	" " <i>abæ</i> sp. nov.	Aba 25, Faradje 4	29
61.	<i>Mops midas</i> (Sundevall).	Faradje 6	6
62.	" <i>congius</i> sp. nov.	Medje 15	15
63.	" <i>niangaræ</i> sp. nov.	Niangara 1	1
64.	" <i>trevori</i> sp. nov.	Faradje 1	1
65.	" ( <i>Allomops</i> ) <i>osborni</i> sp. nov.	Kinshasa 2	2
66.	" " <i>occipitalis</i> sp. nov.	Avakubi 1, Medje 6	7
67.	" " <i>faradjius</i> sp. nov.	Faradje 1	1
68.	" " <i>nanulus</i> sp. nov.	Niangara 7	7

2. List of Localities,<sup>1</sup> with Names of the Species and Subspecies, and Number of Specimens taken at each Locality.

Localities	Species	No. of Specimens	Totals
Aba	<i>Colœura gallarum nilosa</i>	9	
"	<i>Rhinolophus hildebrandti eloquens</i>	3	

<sup>1</sup> The geographical position of the localities is shown on the accompanying map (p. 415).



Localities	Species	No. of Specimens	Totals
Aba	<i>Rhinolophus abæ</i>	10	
"	" <i>axillaris</i>	5	
"	<i>Hipposideros caffer centralis</i>	3	
"	" <i>abæ</i>	35	
"	<i>Myotis bocagii hildegardæ</i>	11	
"	<i>Pipistrellus abaensis</i>	3	
"	<i>Glauconycteris papilio</i>	3	
"	<i>Miniopterus breyeri vicinior</i>	17	
"	<i>Chærephon (Lophomops) abæ</i>	25	124
Akenge	<i>Kerivoula cuprosa</i>	2	2
Avakubi	<i>Eidolon helvum</i>	50	
"	<i>Epomops franqueti franqueti</i>	6	
"	<i>Hypsignathus monstrosus</i>	19	
"	<i>Taphozous mauritanus</i>	3	
"	<i>Saccolaimus peli</i>	4	
"	<i>Nycteris hispida</i>	3	
"	" <i>avakubia</i>	1	
"	" <i>arge</i>	8	
"	<i>Hipposideros caffer centralis</i>	14	
"	" <i>langi</i>	4	
"	<i>Pipistrellus musciculus</i>	1	
"	<i>Mimetillus moloneyi</i>	1	
"	<i>Glauconycteris humeralis</i>	1	
"	<i>Mops (Allomops) occipitalis</i>	1	
"	<i>Chærephon</i> sp. indet.	1	117
Bafwabaka	<i>Hypsignathus monstrosus</i>	6	
"	<i>Saccolaimus peli</i>	1	
"	<i>Myotis bocagii cupreolus</i>	11	
"	<i>Pipistrellus nanus</i>	30	48
Boma	<i>Nycteris hispida</i>	3	
"	<i>Chærephon (Lophomops) cristatus</i>	4	7
Cape Lopez	<i>Epomophorus wahlbergi haldemani</i>	1	1
Dungu	<i>Taphozous sudani</i>	11	11
Faradje	<i>Epomophorus anurus</i>	24	
"	<i>Taphozous mauritanus</i>	41	
"	<i>Nycteris pallida</i>	8	
"	" <i>major</i>	1	
"	<i>Lavia frons affinis</i>	25	
"	<i>Hipposideros caffer centralis</i>	4	
"	" <i>nanus</i>	1	
"	<i>Myotis bocagii hildegardæ</i>	2	
"	<i>Pipistrellus nanus</i>	7	
"	<i>Eptesicus ater</i>	2	
"	" <i>faradjius</i>	14	
"	<i>Pachyotus altilis</i>	2	
"	<i>Glauconycteris papilio</i>	13	
"	<i>Nyctinomus ansorgei</i>	26	

Localities	Species	No. of Specimens	Totals
Faradje	Chærephon (Lophomops) chapini	2	
"	" " abæ	4	
"	Mops midas	6	
"	" faradjius	1	
"	" trevori	1	184
Gamangui	Pipistrellus nanus	1	1
Garamba	Taphozous mauritianus	1	
"	Nycteris major	1	
"	Pipistrellus nanus	1	
"	Eptesicus garambæ	1	4
Isiro	Eptesicus minutus	1	1
Kinshasa	Mops (Allomops) osborni	2	2
Leopoldville	Epomops franqueti franqueti	1	
"	Hipposideros caffer centralis	1	
"	Myotis bocagii bocagii	1	3
Malela	Chærephon frater	22	22
Medje	Eidolon helvum	4	
"	Epomops franqueti franqueti	12	
"	Casinycteris argynnis	1	
"	Myonycteris wroughtoni	4	
"	Saccolaimus peli	4	
"	Nycteris hispida	1	
"	" arge	2	
"	Hipposideros caffer centralis	12	
"	" langi	7	
"	Myotis bocagii cupreolus	3	
"	Pipistrellus nanus	6	
"	Mimetillus moloneyi	2	
"	Pachyotus nigrita nux	2	
"	Glauconycteris humeralis	4	
"	" alboguttatus	1	
"	Kerivoula cuprosa	1	
"	Nyctinomus leonis	1	
"	" ochraceus	22	
"	Chærephon russatus	27	
"	Mops congicus	15	
"	" (Allomops) occipitalis	6	137
Ngayu	Saccolaimus peli	3	
"	Pipistrellus nanus	4	
"	Eptesicus tenuipinnis	7	14
Niangara	Epomops franqueti franqueti	1	
"	Micropteropus pusillus	1	
"	Taphozous mauritianus	2	
"	Saccolaimus peli	4	
"	Nycteris arge	2	
"	Hipposideros caffer centralis	2	
"	" langi	2	

Localities	Species	No. of Specimens	Totals
Niangara	<i>Hipposideros gigas niangaræ</i>	1	
"	<i>Pipistrellus nanus</i>	9	
"	<i>Eptesicus ater</i>	2	
"	" <i>faradjius</i>	10	
"	" <i>minutus</i>	1	
"	<i>Scoteinus schlieffeni</i>	1	
"	<i>Glauconycteris papilio</i>	4	
"	<i>Myopterus albatrus</i>	7	
"	<i>Nyctinomus eisturus</i>	1	
"	<i>Mops niangaræ</i>	1	
"	" ( <i>Allomops</i> ) <i>nanulus</i>	7	58
Niapu	<i>Epomops franqueti franqueti</i>	1	
"	<i>Hipposideros caffer niapu</i>	10	
"	" <i>langi</i>	1	12
Panga	<i>Chærophon leonis</i>	1	1
Penge	<i>Hypsignathus monstrosus</i>	1	1
Poko	<i>Hipposideros caffer centralis</i>	3	
"	<i>Pipistrellus nanus</i>	1	
"	<i>Scotozous rüppelii</i>	1	5
Risimu	<i>Pipistrellus nanus</i>	1	1
Rungu	<i>Saccolaimus peli</i>	1	1
Stanleyville	<i>Epomops franqueti franqueti</i>	2	
"	<i>Hypsignathus monstrosus</i>	4	
"	<i>Nycteris hispida</i>	4	
"	<i>Pipistrellus nanus</i>	6	
"	<i>Mimetillus moloneyi</i>	1	17
Thysville	<i>Miniopterus inflatus</i>	13	13
Vankerckhovenville	<i>Epomops franqueti franqueti</i>	1	
"	<i>Nycteris pallida</i>	4	5
Yakuluku	<i>Taphozous mauritanus</i>	1	
"	<i>Pipistrellus nanus</i>	1	2

### 3. *New Species and Subspecies, with their Type Localities.*

1. *Nycteris pallida*. Faradje.
2. " *avakubia*. Avakubi.
3. *Rhinolophus abæ*. Aba.
4. " *axillaris*. Aba.
5. *Hipposideros caffer niapu*. Niapu.
6. " *abæ*. Aba.
7. " *nanus*. Faradje.
8. " *langi*. Avakubi.
9. " *gigas niangaræ*. Niangara.
10. *Pipistrellus abaensis*. Aba.
11. *Eptesicus ater*. Faradje.
12. " *faradjius*. Faradje.
13. " *garambæ*. Garamba.

14. *Glauconycteris humeralis*. Medje.
15. " *albuguttatus*. Medje.
16. *Miniopterus breyeri vicinior*. Aba.
17. *Nyctinomus ochraceus*. Medje.
18. " *frater*. Malela.
19. *Chærephon russatus*. Medje.
20. " (*Lophomops*) *chapini*. Faradje.
21. " " *cristatus*. Boma.
22. " " *abæ*. Aba.
23. *Mops congicus*. Medje.
24. " *niangaræ*. Niangara.
25. " *trevori*. Faradje.
26. " (*Allomops*) *osborni*. Kinshasa.
27. " " *occipitalis*. Avakubi.
28. " " *faradjius*. Faradje.
29. " " *nanulus*. Niangara.

## GENERAL SUMMARY.

Families	Genera	Species and Subspecies	Specimens	Localities <sup>1</sup>
Pteropidæ	7	8	140	11
Emballonuridæ	3	4	87	10
Nycteridæ	1	5	37	8
Megadermidæ	1	1	25	1
Rhinolophidæ	2	9	118	9
Vespertilionidæ	10	23	206	17
Molossidæ	4	19	183	9
	28	69	796	

## MEGACHIROPTERA.

## PTEROPODIDÆ.

1. *Eidolon helvum* (Kerr).

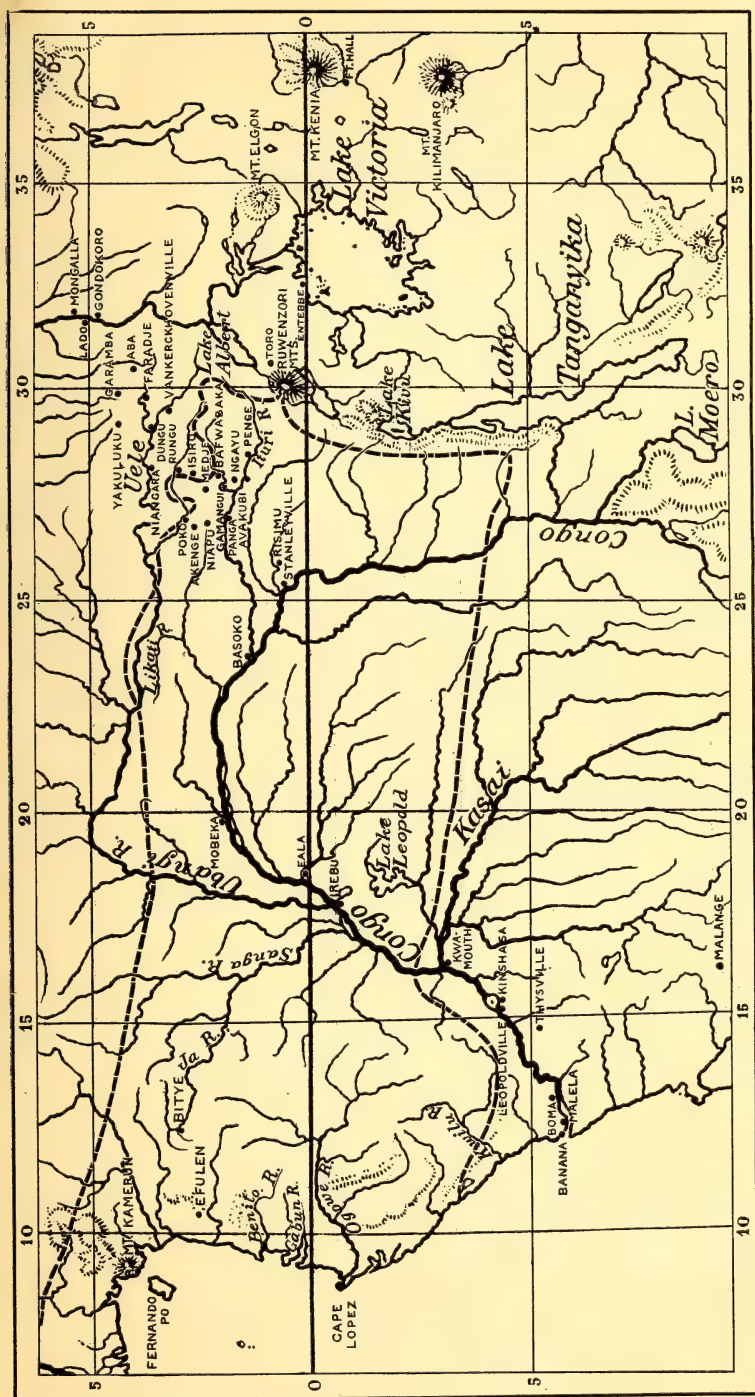
Plate XLIV, Fig. 3.

*Vespertilio vampyrus helvus* KERR, Anim. Kingd., I, 1792, p. 91, No. 108.*Eidolon helvum* ANDERSEN, Cat. Chirop., ed. 2, I, p. 8, 1912. Type locality, Senegal (Andersen).

Fifty-four specimens (33 males, 21 females), collected as follows: Avakubi, 50, Nov. 20, 1909, Sept. 9, Oct. 1, 1913, May 14-16, June 5, 1914; Medje, 4, June 6, May 20-22, 1914. Thirty-seven of the Avakubi specimens

<sup>1</sup> The total number of localities at which bats were collected is 27.





Map of the Congo and Lake Region of Africa, showing all the localities where bats were collected by the Congo Expedition, as well as others mentioned in the present paper. The limits of the West African rain forest are indicated by a broken line.

were taken in one day, Nov. 20, 1909. Of the males 23 are adult and 10 immature; of the females 8 are adult and 13 immature. There are no very young specimens. About 6 specimens are in alcohol, the others being skins with skulls.

There is practically no sexual difference in size and very little in color. Young of the year are paler than adults, especially on the ventral surface, and lack the tawny color on the foreneck.

Collectors' measurements (20 adult males, 8 adult females):

	Head and body	Tail	Foot	Ear
♂	204 (192-214)	12 (6-20)	34 (31-37)	31 (29-33)
♀	207 (194-215)	14.5 (10-19)	33.5 (32-35)	31.8 (30-33)

*Measurements of Skull and Forearm in 21 Males.<sup>1</sup>*

Cat. No.	Length	Zygom. breadth	Maxill. tooththrow	Palatal length	Palatal breadth	Forearm
48663	56	—	18.4	28	18	126
48665	55	31	17.3	28.3	17	119
48670	53.8	33.6	17	27.8	17.4	120
48671	53.7	32.6	18	27.6	17	122
48672	53	33.5	17	27.8	17	118
48674	55	32.7	18	29.7	17.2	126
48675	52.3	32	17	27	16.5	115
48677	55	34.2	18	27.8	17	122
48681	56	34	18.3	29	17.5	124
48682	54.5	33	18	28	16	123
48685	52	33.2	18	27	16.8	120
48687	52	33.2	17	25.2	17	115
48688	52.5	33.2	16.6	26.8	16.5	115
48689	51.5	32.3	17.2	26.8	16.5	115
48690	54.7	33	17.8	27.6	16	123
48691	54	—	17.3	28	17	114
48693	54	—	18.3	27.8	17.6	120
48696	53	32	17.2	27	15.8	119
48697	51.5	32.3	16.8	26.2	17.3	116
48704	53.6	32	18	27.3	18	123
48706	58	34.8	19	30	18	121
Average	54.2	32.8	17.7	28.1	17.5	119
Minimum	51.5	31	16.6	25.2	15.8	114
Maximum	58	34.8	19	30	18	126

<sup>1</sup> *Explanation of measurements.*—Length = front border of premaxillaries to posterior border of occipital condyles; palatal length = posterior border of palatal foramina to posterior palatal border; palatal breadth = outside to outside of last upper molars.

*Measurements of Skull and Forearm in 6 Females.<sup>1</sup>*

Cat. No.	Length	Zygom. breadth	Maxill. toothrow	Palatal length	Palatal breadth	Forearm
48664	53	33	17	27	17	123
48668	54	33	17	26.3	17.1	119
48673	54	33	16.6	28	17	125
48680	55	34	17.5	27	17.1	127
48683	52.5	31	18	27	17.5	122
48705	54.1	31.8	17.1	27	16.2	123
Average	53.8	32.6	17.2	27.5	17	123
Minimum	52.5	31	16.6	26.3	16.2	119
Maximum	55	34	18	28	17.5	127

In all the skulls except one (No. 48665, ♂) the bones of the skull are completely fused; in this the nasal sutures are still open, yet this skull, judging by other features, is one of the oldest of the series. In cranial measurements the sexes are similar, but the small series of females indicates a greater length of forearm than in the males, an apparent difference that would probably disappear in a larger series. The cranial measurements of males and females are practically the same.

2. *Epomops franqueti franqueti* (Tomes).

Plate XLIV, Fig. 2; Plate XLV.

*Epomophorus franqueti* TOMES, Proc. Zool. Soc. London, 1860, p. 54, pl. lxxv. Gaboon.

Twenty-four specimens (20 skins, 4 in alcohol), collected as follows: Leopoldville, 1; Niangara, 1; Medje, 12; Vankerckhovenville, 1; Avakubi, 6; Stanleyville, 2; Niapu, 1. Most of the specimens are immature, only 10 (4 males, 6 females) being fully adult. Fourteen are sexed as males, 10 as females.

Collectors' measurements (3 adult males, 4 adult females):

	Total length	Tail	Foot	Ear
♂	171 (160-178)	0	26 (24-28)	28.3 (28-29)
♀	154 (150-157)	0	24 (23-25)	26.5 (25-27)

<sup>1</sup> Measurements as in preceding table.

*Measurements of Skull and Forearm in 3 Males and 5 Females.*<sup>1</sup>

Cat. No.	Sex	Length	Zygom. breadth	Maxill. toothrow	Palatal length	Palatal breadth	Forearm
48724	♂	51.4	28.6	11.5	26.4	16	96
48725	♂	51	28	12.1	26.1	15.3	97
48729	♂	52.5	—	11.6	25.6	15.4	—
Average		51.6	28.3	11.7	26.3	15.6	
Minimum		51		11.5	25.6	15.3	
Maximum		52.5		12.1	26.4	16	
48714	♀	44.5	27.3	10.8	22.3	14.7	91
48719	♀	44.4	26.2	10.8	22.5	14.6	87
48721	♀	45	25.5	10.1	21.5	14	92
48723	♀	44.4	27.1	10	21.5	14.2	—
48726	♀	45.8	27.2	11.4	22.4	14	88
Average		44.9	26.6	10.6	22	14.3	89
Minimum		44.4	25.5	10	21.5	14	87
Maximum		45.8	27.3	11.4	22.5	14.7	92

As shown above, the males considerably exceed the females in size. In two of the adult males the shoulder tufts are white, in the other deep yellow. There is a wide range of color variation, due apparently to differences in age. In one of the females (No. 48723) there is a minute premolar in front of p<sup>3</sup>, and another female (No. 48719) has four upper incisors, probably the outer pair retained from the milk dentition.

3. *Hypsignathus monstrosus* H. Allen.

Plate XLIV, Fig. 4; and Text Figs. 2 and 16 (p. 485), 18–20 (pp. 503, 506, 507).

*Hypsignathus monstrosus* H. ALLEN, Proc. Acad. Nat. Sci. Philadelphia, 1861, p. 157. West Africa (= Gaboon).

Thirty specimens (26 skins, 4 in alcohol), collected as follows: Avakubi, 19; Stanleyville, 4; Bafwabaka, 6; Penge, 1. Adult males, 10; \*adult females, 4; immature specimens, 16.

Collectors' measurements (9 adult males, 4 adult females):

	Head and body	Tail	Foot	Ear
♂	253 (248–260)	0	38 (36–40)	36 (35–39)
♀	203 (198–210)	0	35 (33–36)	33 (31–34)

Expanse of wing, two males, 950 and 967; one female, 840.

<sup>1</sup> Measurements as in preceding tables.



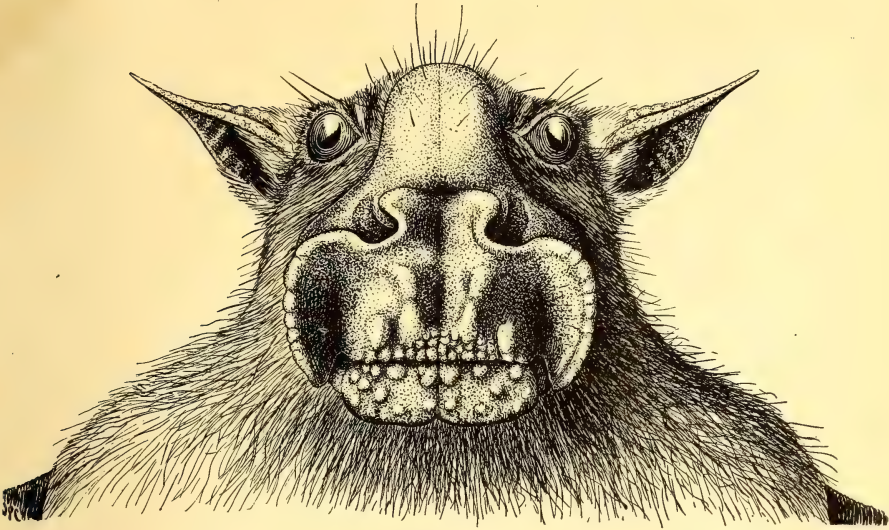


Fig. 2. *Hypsignathus monstrosus*. Direct front view of head, adult male, from a freshly killed specimen.  $\frac{1}{2}$ .

See also Text Figs. 16 and 18 (pp. 485 and 503) for illustrations, respectively, of head and cheek-pouches, and Text Figs. 19 and 20 (pp. 506 and 507) for laryngeal and visceral anatomy.

*Measurements of Skull and Forearm in 10 adult Males and 4 adult Females.*

Cat. No.	Sex	Condylol-basal length	Zygom. breadth	Upper pm-m. series	Palatal length	Palatal breadth	Forearm
48629	♀	61	32.5	13.8	30	19	123
48652	♀	60	33.3	13.5	30	18.4	121
48628	♀	60	32.5	14	30	17.8	121
48636	♀	60	33	14.8	30.6	19	118
48637	♂	72	36.4	15	36.3	21.4	134
48638	♂	73.5	37	16	38.5	23.3	137
48639	♂	70.3	37	16.7	36.2	22	132
48640	♂	71.8	37	15.7	37	22	134
48641	♂	71	37.3	15.5	35.3	21.2	137
48642	♂	70.5	37.3	15.3	36	23	131
48648	♂	72	37.5	15.8	36	22.4	133
48649	♂	73.2	38.6	16	37	23	133
48653	♂	70.8	35.6	15.6	36	21.8	—
48654	♂	72.5	36.8	16	36	22.3	131
Average	10♂	71.8	37	15.8	36.5	22	133
Minimum		70.3	35.6	15	36	21.2	131
Maximum		73.5	38.6	16.7	38.5	23.3	137
Average	4♀	60.2	32.8	14.2	30.2	19.5	121

The females in this species are much smaller than the males.

4. *Epomophorus anurus* Heuglin.

Plate XLIV, Fig. 1; Plates XLVI, XLVII.

*Epomophorus anurus* HEUGLIN, N. Act. Ac. Cæs. Leopold., XXXI, Abh. viii, 1864, p. 12. Bongo, Bahr-el-Ghazel, Sudan.

Twenty-four specimens (20 skins, 4 in alcohol), all collected at Faradje, Sept.-Oct., 1912. Males, 10, females, 14; only 12 specimens are adult. Only 5 of the males have shoulder tufts, which are well developed in only 3.

Collectors' measurements (5 males, 6 females):

	Head and body	Foot	Ear
♂	139 (135-145)	23.5 (22-25)	23.6 (23-25)
♀	129 (125-135)	21.3 (21-24)	22.5 (21-25)

For 2 adult females the length of the tail is given as, respectively, 2 and 3 mm.; in 3 immature females as, respectively, 2, 6, 2 mm.

*Measurements of Skull and Forearm in 5 Males and 6 Females.*

Cat. No.	Sex	Condylorbasal length	Zygom. breadth	Upper pm-m. series	Palatal length	Palatal breadth	Forearm
48733	♂	46.4	24.9	—	27	12.6	76
48734	♂	48.2	23.6	11	28.1	13.1	77
48738	♂	45.8	26.7	11.8	26	13.2	76
48750	♂	46.8	24.9	9.6	27.1	12.5	77
48761	♂	46.5	25	10.7	26.9	13.1	76
Average	♂	46.7	24.6	10.8	27	12.9	76.4
Minimum	♂	45.8	23.6	9.6	26	12.5	76
Maximum	♂	48.2	25	11.8	28.1	13.2	77
48735	♀	41.6	23.2	9.7	23.7	12.2	75
48732	♀	42.1	22.7	9.7	23.5	11.6	71
48739	♀	43.8	23.9	9.9	24.5	13.1	73
48740	♀	42	22.9	9.9	23.8	12.1	74
48741	♀	41.6	22	9.8	23	12.1	74
48744	♀	40.9	22.6	9.8	22.8	11.4	72
Average	♀	42	22.9	9.8	23.5	12.1	73
Minimum	♀	40.9	22	9.7	22.8	11.4	72
Maximum	♀	43.8	23.9	9.9	24.6	13.1	75

This series presents a wide range of color variation, the palest, a female, being pale ochraceous buff, while another female and one male are also much paler than the average. In quite a number of the younger specimens the wing membranes are distinctly barred with dark bands, in one or two strongly so.

This series extends the known range of *Epomophorus anurus* somewhat to the westward of records given by Andersen (Uganda and Ruwenzori).

### 5. *Epomophorus wahlbergi haldemani* (Hallowell).

*Pteropus haldemani* HALLOWELL, Proc. Acad. Nat. Sci. Philadelphia, 1846, p. 52. West Africa.

One specimen (No. 48662), Cape Lopez, Feb. 10, 1915, an adult male with small shoulder tufts.

Collectors' measurements: Total length (head and body), 345; foot, 25; ear, 23.

Skull and forearm: Condylobasal length, 49.2; zygomatic breadth, 26.5; upper premolar-molar series, 11.5; palatal length ("palation to incisive foramina"), 26.1; outside to outside of crowns of  $m^1$  (maxillar breadth), 14.3; forearm, 81.

### 6. *Micropteropus pusillus* (Peters).

*Epomophorus pusillus* PETERS, Monatsb. Akad. Berlin, 1867, p. 870. Yoruba, southwestern Nigeria.

One specimen, subadult male, skin and skull, Niangara, Nov. 18, 1910. Forearm, 45; foot, 15; ear, 14; length of skull, 24; mandible, 18.

### 7. *Casinycteris argynnis* Thomas.

*Casinycteris argynnis* THOMAS, Ann. and Mag. Nat. Hist. (8), VI, p. 111, July, 1910. Bitye, Ja River, S. E. Cameroons. Altitude 2000 feet.

One specimen (No. 48751), adult female, skin and skull, Medje, April 22, 1910.

Collectors' measurements: Total length, 92; tail, 0; hind foot, 15; ear, 17. Forearm (from skin), 60.

Skull, total length, 26; condylobasal length, 24.5; zygomatic breadth, 19; mastoid breadth, 12; maxillar breadth, 10; interorbital breadth, 5.2; breadth at base of canines, 5.5; maxillary tooththrow (including canine), 7.8; length of mandible, 19.4; height at coronoid, 8.7; mandibular tooththrow (including canine), 9.6.

8. *Myonycteris wroughtoni* K. Andersen.

*Myonycteris wroughtoni* ANDERSEN, Cat. Chiropt. Br. Mus., I, 1912, p. 580. Likati River, Welle district, N. E. Congo.

Four specimens: 1 adult male, 2 adult females, 1 half-grown young, Medje, April 4, 16, and Sept. 6, 1914.

The three adults are slightly smaller than the measurements given by Andersen of the male type and male paratype, although the teeth in the Medje specimens are considerably worn, indicating full maturity. The forearm averages 4 mm. shorter, with all other wing measurements in proportion. The skull measurements are also slightly less, averaging about 1 mm. shorter, and the zygomatic breadth is fully 1 mm. less, with other skull measurements proportionally smaller. The neck ruff in the male is also dull yellow orange instead of "tawny olive." One of the females (taken April 16) has the upperparts vandyke brown, a little lighter across the neck and on the head than the back. The male (taken April 4) is much lighter, the upperparts being light brown with a faint suffusion of cinnamon buff, lighter on the head and hindneck. The other adult female, taken September 6, hanging in a bush with the young one, has the upperparts tawny, the head and shoulders a little lighter than the back, and is thus very different in color from the young one taken with her, and from the other adult female taken in April. These color differences may be in part seasonal, or merely individual.

Collectors' measurements: Head and body, ♂ 130, ♀ 114, ♀ 162; tail, ♂ 4, ♀ 12, ♀ 6; foot, ♂ 18, ♀ 18, ♀ 22; ear, ♂ 18, ♀ 19, ♀ 20.

*Measurements of Skull and Forearm.*

Cat. No.	Sex	Length	Zygom. breadth	Upper teeth (c-m <sup>2</sup> )	Lower teeth (c-m <sub>3</sub> )	Palatal length	Across m <sup>3</sup> -m <sup>3</sup> outside	Forearm
48755	♂	33.7	—	12.7	13.5	16.6	9.8	60.7
48752	♀	32.9	20	12.7	14.5	16	10.1	61
48754	♀	33.6	19.8	12	13.7	16.7	9.2	64
Type <sup>1</sup>	♂	34	21	13	14.5	16.5	10.2	67
Paratype <sup>1</sup>	♂	—	—	13.8	14.5	16.8	10.4	65

<sup>1</sup> From Andersen (*l. c.*, pp. 583-584), for comparison.



## MICROCHIROPTERA.

## EMBALLONURIDÆ.

9. *Taphozous mauritanus* Geoffroy.

Plate XLVIII, Fig. 1.

*Taphozous mauritanus* E. GEOFFROY, Descrip. de l'Égypte, II, 1813, p. 127. Ile de France.

Forty-eight specimens (36 skins, 12 alcoholics), collected as follows: Niangara, 2 (skins), Nov. 18–25, 1910; Faradje, 41 (34 skins, 7 alcoholics), Feb. 6, April 1, May 17–28, June 7, July 11, 1911, and Oct. 22–26, Nov. 12–19, Dec. 7–16, 1912; Avakubi, 3 (in alcohol); Garamba and Yakuluku, 1 each (in alcohol).

Collectors' measurements (6 adult males, 10 adult females):

	Total length	Head and body	Tail	Foot	Ear
♂	104 (100–109)	82.5 (80–87)	22 (20–26)	13.2 (12–14)	18.2 (17–19)
♀	106.5 (102–109)	81.6 (77–89)	23.9 (22–26)	13.8 (12–14)	18.2 (17–22)

Forearm, same specimens, ♂ 60.5 (59–62), ♀ 62 (58–65.6).

Skull, same specimens: Total length, ♂ 21.8 (21.3–22.5), ♀ 21.6 (20.6–22.5); zygomatic breadth, ♂ 12.4 (12.2–13.1), ♀ 13 (12–13.8).

The females in the present series slightly exceed the males in size, but the sexes are not distinguishable on the basis of either size or color. The slight range of color variation seems to be correlated with wear and fading, the white tips of the hairs becoming shorter and less conspicuous through abrasion prior to the moult.

10. *Taphozous sudani* Thomas.

*Taphozous sudani* THOMAS, Ann. and Mag. Nat. Hist. (8), XV, p. 561, June, 1915. Mongalla, Sudan, "just north of Lado," Upper Nile.

Eleven specimens, 3 skins and skulls and 8 in alcohol, Dungu, March 1, 1913.

Collectors' measurements (2 females, 1 male), total length, 109 (105–111); head and body, 80.7 (78–82); tail, 28 (27–29); foot, 15 (all 15; 13–14 in dry skin); ear, 19.7 (19–20): Forearm, same specimens (from skins), 64.6 (63.6–65.4). Skull, total length, 20.3 (19.6–21); condylobasal length,



19.4 (19–19.7); zygomatic breadth, 12.3 (12.2–12.4). Forearm in 8 alcoholic specimens (4 males, 4 females), ♂ 64.4 (63.6–65), ♀ 65.2 (65.1–65.3).

# 11. *Saccolaimus peli* (Temminck).

Plate XLIX, and Text Fig. 16.

*Taphozous peli* TEMMINCK, Esquiss. Zool. sur la Côte de Guinée, 1853, p. 82. Gold Coast.

Seventeen specimens (7 males, 10 females, all adult), collected as follows: Avakubi, 4 (including 1 alcoholic), Nov. 16, Dec. 18, 1909, Jan. 15–17, 1914; Ngayu (near Avakubi), 3, Dec. 18, 1909; Bafwabaka, 1, Dec. 28, 1909; Medje, 4, Jan. 14–19, 1910; Niangara, 4, May 27–31, 1913; Rungu, 1, June 28, 1913.

Collectors' measurements (6 adult males, 10 adult females):

	Total length	Head and body	Tail	Foot	Ear
♂ 139 (130–149)	109 (103–116)	29.8 (27–33)	25 (23–27)	26.5 (25–29)	
♀ 145 (135–157)	115 (104–126)	30.6 (26–39)	24.8 (22–26)	25.3 (22–30)	

Forearm (same specimens), ♂ 88.2 (86.5–94.5), ♀ 88.1 (83.5–92).

Skull (4 males, 8 females): Total length, ♂ 30.4 (29.8–31), ♀ 30.5 (29.8–31); zygomatic breadth, ♂ 20.1 (18–21), ♀ 20.9 (19.3–21.8).

In external measurements the males average somewhat smaller than the females, particularly in size of body and length of forearm, while the skull measurements are practically the same. The coloration is remarkably constant throughout the series.

The folding of the tip of the wing is illustrated in Part II, p. 515, Fig. 21.

# 12. *Colëura gallarum nilosa* Thomas.

*Colëura gallarum nilosa* THOMAS, Ann. and Mag. Nat. Hist. (8), XV, p. 577, June, 1915. Near mouth of Bahr-el-Zeraf, White Nile.

Nine specimens, skins and skulls, Aba, Dec. 16, 1911.

Collectors' measurements (6 adults): Total length, 76 (71–79); head and body, 60 (55–63); tail, 16 (14–17); foot, 11.5 (10–12); ear, 16 (15–17).

Forearm (same specimens, from skins), 49.3 (47.3–51). Four skulls (from same), total length, 16.3 (15.8–16.7); condylobasal length, 15.5 (15–15.8); breadth of braincase, 7.7 (7.2–8).

## NYCTERIDÆ.

13. *Nycteris hispida* (Schreber).

*Vespertilio hispida* SCHREBER, Säugeth., I, p. 169, pl. lvi, 1775. Senegal.

Eleven specimens (5 skins, 6 alcoholic), collected as follows: Boma, 3 (alcoholic); Stanleyville, 4 (2 alcoholic); Avakubi, 3 (1 alcoholic); Medje, 1.

Collectors' measurements (1 male, Stanleyville, 3 females, Avakubi): Total length, 99.5 (96–101); head and body, 52 (50–54); tail, 48 (45–50); ear (from outer base), 23 (22–25).

Forearm (6 specimens, Avakubi and Stanleyville), 41.3 (40–43.4).

Skull (3, Avakubi), total length, 17.9 (17.4–18.4); zygomatic breadth, 10.6 (10.5–10.8).

In the 5 skins the upperparts are dark brown (blackish brown on middle of back), underparts brown, ears and membranes blackish brown.

14. *Nycteris pallida* sp. nov.

Type, No. 49144, ♂ ad., Faradje, Belgian Congo, March 1, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1858.

A pale small form of the *N. hispida* group, differing strongly from typical *hispida* in its pale coloration and also slightly in smaller size.

Above pale brown, the tips of the hairs on the lower back and sides pale fulvous; underparts grayish brown; head back to the ears very pale brown, in strong contrast with the body; a narrow whitish band bordering the nose pad in front and laterally; ears light brown terminally, much paler basally; membranes much paler than in *hispida*.

Collectors' measurements of type: Total length, 92; tail, 45; foot, 10; ear, 21 (in skin from anterior border, 15.5).

Additional measurements from type: Forearm, 39.5; tibia, 19; foot, 9.2. Forearm in 5 alcoholics (Faradje, 3, Vankerekhovenville, 2), 37.8 (36.5–39.5).

Skull (type), total length, 17.4; zygomatic breadth, 10.2; upper toothrow (c-m<sup>3</sup>), 6.5; lower jaw, 11.8; lower toothrow, 6.8. Type and three topotypes, total length, 17.2 (16.9–17.4); zygomatic breadth (2 skulls), 10.2 (10.1–10.3).

Represented by 12 specimens (3 skins, 9 alcoholics, part immature), of which 8 are from Faradje, and 4 from Vankerekhovenville.

Present material indicates that *N. pallida* differs from *N. hispida*, its nearest ally, in much paler coloration, including especially the ears and membranes, and smaller size, averaging about 4 mm. less in the length of the forearm, with other measurements proportional. *N. pallida* is thus much smaller than *N. aurita* Andersen.

15. *Nycteris avakubia* sp. nov.

Type (and only specimen, in alcohol), No. 49403, ♂ ad., Avakubi, Belgian Congo, September, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2623.

A member of the *N. hispida* group, intermediate in size between *N. hispida* and *N. grandis*. Upper incisors trifold,  $p_4$  large, fully one third the size of  $p_3$ , and similar



Fig. 3. *Nycteris avakubia*. Head, from field sketch of type, No. 49403, male.  $\frac{4}{3}$ .

to it in general form. Coloration not distinctive, but very dark including ears and membranes, in the single specimen in alcohol.

Total length, 137 (150,<sup>1</sup> 144.7); head and body, 63(—, 71); tail, 65 (70, 73.7); ear, 25 (32, 30.5); forearm, 51 (59.5, 57); third finger, metacarp, 40 (44, 43.2); tibia, 30 (25.5, 31.8); foot, 12 (18.5, 15.2); calcaneum, 20 (23, 22.9).

Skull, total length, 22.4; zygomatic breadth, 12.9; upper tooththrow ( $c-m^3$ ), 7.7; length of mandible, 15.1; lower tooththrow ( $c-m_3$ ), 8.4.

Represented only by the type (in alcohol) taken at Avakubi.

16. *Nycteris arge* (Thomas).

*Petalia arge* THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 633, Dec. 1903. Efulen, Cameroons.

Twelve specimens (4 males, 8 females, all adult, of which 4 are alcoholics), collected as follows: Avakubi, 8 (6 skins, 2 alcoholic), Oct. 13,

<sup>1</sup> The first measurements in parenthesis are of *Nycteris grandis* as given by Peters (Monatsb. Akad. Wissens. Berlin, 1866, p. 672) from a specimen in the British Museum; the second are from apparently the same specimen as given by Dobson (Cat. Chiropt. Br. Mus., 1878, p. 164).



Nov. 16-28, 1909, Jan. 28, 1914; Medje, 2 (skins), May 3, 1909; Jan. 16, 1910; Niangara, 2 (alcoholic), March 27, 1913.

Collectors' measurements (2 males, 5 females):

	Total length	Head and body	Tail	Foot	Ear
♂ 114 (112–116)	57.5 (56–59)	56.5 (56–57)	10 (10–10)	31 (31–31)	
♀ 114 (111–117)	56 (51–60)	58 (56–61)	10.4 (10–12)	32 (30–34)	

Forearm (same specimens), 42.8 (41.6-43.5). Lower leg and foot (5 Avakubi specimens), 32.5 (32.2-33.5).

Skull (2 males, 5 females), total length, ♂ 19.6 (19.3-19.9); ♀ 20.2 (19.8-20.9); zygomatic breadth, ♂ 11.2 (11.1-11.4); ♀ 11.6 (11.1-12.6).

The following measurements are from 3 alcoholics (Avakubi, 1 ♂, Niangara, 2, ♂ and ♀): Forearm, 43 (41-44.7); third metacarpal, 33.5 (30-36); ear, 25 (23-27).

### 17. *Nycteris major* (Andersen).

*Petalia major* ANDERSEN, Ann. and Mag. Nat. Hist. (8), X, p. 547, Nov. 1912. Ja River, Cameroons.

Two specimens (alcoholic): Garamba, male, June (1912); Faradje, male, Sept. (1913); both adult.

Forearm, 49.5 (49-50); third metacarpal, 39.3 (37-41); skull (Avakubi specimen), total length, 22.4; zygomatic breadth, 12.9.

So far as can be determined from the brief original description of *P. major* (*l. c.*), these specimens should be referred to it.

## MEGADERMIDÆ.

### 18. *Lavia frons affinis* Andersen and Wroughton.

#### Plate L.

*Lavia frons affinis* ANDERSEN and WROUGHTON, Ann. and Mag. Nat. Hist. (7), XIX, p. 140, Feb., 1907. Kaka, White Nile.

Twenty-five specimens (11 males, 14 females, of which 4 are alcoholics), all taken at Faradje, as follows: April 23-26, Nov. 5-15, 1911; Jan. 1, 2, 19, Mch. 26, Sept. 25, Oct. 21, Dec. 3, 15, 29, 1912. Adults, 18; immature, 7.

Collectors' measurements (4 adult males, 8 adult females):

Head and body	Tail	Foot	Ear
♂ 75 (70–80)	0	19 (19–19)	41 (40–42)
♀ 75.8 (73–79)	0	19 (18–20)	41.7 (40–43)

Forearm (same specimens), ♂ 57.6, (55–58.8), ♀ 58 (55–61).

Skull (same specimens), total length ♂ 25.1 (25–25.3); ♀ 24.4 (21.3–25.4); zygomatic breadth, ♂ 14.8 (14.4–15.2), ♀ 14.9 (14.4–15.2).

#### RHINOLOPHIDÆ.

##### 19. *Rhinolophus hildebrandti eloquens* Andersen.

*Rhinolophus hildebrandti eloquens* ANDERSEN, Ann. and Mag. Nat. Hist. (7), XV, p. 74, Jan. 1905. Entebbe, Uganda.

Three specimens, skins and skulls (1 male, 2 females), Aba, Dec. 15–17, 1911.

Collectors' measurements: Total length, 96.3 (91–100); head and body, 67 (65–70); foot, 14.7 (14–17); ear (outer base to tip), 29.3 (29–30).

Forearm (from skin), 56.2 (55–57.5). Skull, total length, 26.8 (26.8–26.9); zygomatic breadth, 13.2 (12.8–13.7). A minute  $p^2$  present on both sides in two skulls, wholly lacking in the other skull.

##### 20. *Rhinolophus abæ* sp. nov.

Type, No. 49113, ♀ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 15, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1756.

General coloration drab-brown, a little darker above than below, the middle of the back slightly darker (blackish brown) than the rest of the upperparts, sides of the shoulders a little lighter. Fur almost uniformly colored from base to tip, the median zone being only slightly lighter than the base and tips.

Ears long and pointed, the anterior border slightly convex (increasingly so apically), the posterior nearly straight (slightly concave toward the apex), the antitragus large and high (vertical depth anteriorly 5–6 mm.). Breadth of horseshoe in skins (when not unduly shrunken), 8.5–9.5 mm. Nose-leaf broad at base (about 6.5 mm.), acutely pointed, and about 6 mm. in length. Sella about 3 mm. broad at base and 4 in height (as nearly as can be judged in softened skins), slightly concave on anterior face, with a posterior extension of about 3 mm., highest in front with a slight median axial depression.

Type, collectors' measurements: Total length, 85; head and body, 63; tail, 24; foot, 12; ear, 24. Forearm (from skin), 52.3; tibia, 20; foot, 11.

Skull (type), total length, 22.9; zygomatic breadth, 11.9; breadth at canines, 5.8; maxillary breadth, 8.1; upper toothrow (front of  $c-m^3$ ), 7.8; lower jaw (incisors to condyle), 15.1; lower toothrow ( $c-m_3$ ), 8.8.

Represented by ten specimens, skins and skulls (2 males, 8 females) all collected at Aba, December 15–17, 1911.

Collectors' measurements (1 male,<sup>1</sup> 7 females, all adult):

<sup>1</sup> The other male is subadult, and one of the females has measurements that obviously do not belong to it.

Total length	Head and Body	Tail	Foot	Ear
85 (80-89)	61 (57-64)	24 (22-27)	12 (11-13)	22.9 (22-24)

Forearm, same specimens, 53 (50-54). Skull (6 specimens), total length, 23 (21.9-23.6); zygomatic breadth, 11.7 (11.3-12.2); breadth at base of canines (9 specimens), 5.9 (5.6-6.2); maxillar breadth (across front corner of  $m^3$ ), 8.3 (7.8-8.6).  $P^2$  is present on both sides in 3 skulls, on one side in 2 skulls, and absent on both sides in 4 skulls.

The series is very uniform in coloration; an immature male differs from the others in being lighter and grayer, and is somewhat smaller.

This form appears to be a northern representative of the *Rhinolophus auger* group, of which several forms have been described from the Zambesi region and southward by K. Andersen.<sup>1</sup>

## 21. *Rhinolophus axillaris* sp. nov.

Plate LI, Fig. 2.

Type, No. 49175, ♂ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 17, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1807.

Apparently a member of the *R. landeri* group. Has two phases, a dark brown and a rufous phase.

*Dark phase*.—Type, above dark hair-brown with a faint rufescent tone in strong light, the fur dull gray-brown basally, with long hair-brown tips (in some specimens forming a dark broad V-shaped area on the lower back); below much lighter, the fur pale brownish plumbeous basally, the tips darker, giving a pale brownish wash. At the base of each arm is an axillar patch of short, stiff, dark rust-colored hairs, about 4 by 6.5 mm. in area, in strong contrast with the surrounding fur, both in color and texture. Ears and feet pale brown, membranes darker.

Total length (collectors' measurements), 77 mm.; head and body, 52; tail, 23; foot, 11; ear, 18.

*Rufous phase*.—Above rich cinnamon-brown, the fur basally pale gray, with long dark cinnamon-brown tips; below pale buffy white, with a grayish tone.

The red phase is represented by a single specimen, in which the glandular axillary area is pale yellow. The dark phase is represented by 4 specimens, in one of which an axillar glandular area is not evident, and in a second is less strongly marked than in the other two. All were taken at the same locality and practically on the same date (three on Dec. 17, the other two respectively on Dec. 13 and 15).

Collectors' measurements (3 males, 2 females): Total length, 79 (75-84); head and body, 54 (52-58); tail, 26 (23-29); foot, 11 (10-12); ear, 19 (18-22).

The skull of the type is badly crushed. The measurable skulls give the following: Total length, 3 skulls, 20 (all 20); zygomatic breadth, 2 skulls, 10.2 and 9.6; breadth at base of canines, 4 skulls, 5.4 (5-5.5); breadth at  $m^3$ , 6.9 (6.7-7.2).

<sup>1</sup> Five new *Rhinolophi* from Africa. Ann. and Mag. Nat. Hist. (7), XIV, pp. 378-388, Nov., 1904.



P<sup>2</sup> is greatly reduced but stands in the toothrow, closely crowded between the canine and p<sup>3</sup>.

A peculiar and strongly marked feature of this species is the axillar gland, rendered conspicuous by a short tuft of stiff rust-colored hairs.

## 22. *Hipposideros caffer centralis* Andersen.

*Hipposideros caffer centralis* ANDERSEN, Ann. and Mag. Nat. Hist. (7), XVII, p. 277, March, 1906. Entebbi, Uganda.

Thirty-nine specimens, of which 22 are skins with skulls and 17 are alcoholic. The sexes are about equally represented; only one specimen is immature (about half-grown). They were collected as follows: Leopoldville, 1, July 10, 1909; Avakubi, 14, Sept. 9-Dec. 2, 1909; Medje, 12, Jan. 20-22, March 11, 23, August 3, 1910; Niangara, 2, Nov. 19, 1910; Faradje, 4, Oct. 22-Nov. 20, 1911; Aba, 3, Dec. 13, 1911; Poko, 3.

Field measurements by the collectors:

Avakubi, 5 specimens: Total length, 93 (86-101); head and body, 58 (55-62); tail, 30.8 (30-39); foot, 10 (10-10); ear, 15.2 (14-16).

Medje, 7 specimens: Total length, 91.7 (88-97); head and body, 57 (53-61); tail, 30 (30-39); foot, 10.4 (10-11); ear, 16.3 (14-18).

Forearm: Avakubi, 6 specimens (from skins), 49.3 (47.2-51.2); 7 specimens (alcoholic), 49.7 (48-51). Medje, 7 specimens (from skins), 52.7 (50.9-54.8).

As shown by the foregoing, the series from Avakubi is slightly smaller in length of forearm than the Medje series, while the collectors' measurements of the Avakubi series average larger. The skull measurements of the two are slightly larger in the Medje series.

### Average Measurements of Skulls.

	Avakubi 5 skulls	Medje 9 skulls
Total length	18.3 (17.9-19)	18.8 (18.4-19.8)
Zygomatic breadth	9.7 ( 9.4-10)	10.3 ( 9.8-10.6)
Maxillar breadth	6.2 ( 5.7- 6.6)	6.8 ( 6.2- 7.2)
Breadth at base of canines	3.9 ( 3.7- 4.2)	4.4 ( 4 - 4.6)
Upper toothrow (c-m <sup>3</sup> )	6.1 ( 5.9- 6.5)	6.6 ( 6.1- 7.4)
Lower jaw (front of incisors to back of condyle)	11.4 (10.9-11.9)	11.8 (11 -12.4)
Lower toothrow (c-m <sub>3</sub> )	7.0 ( 6.4- 7.6)	7.9 ( 7 - 8.4)

In the Avakubi series only one skull has a total length of 19 mm. and a zygomatic breadth of 10 mm.; in the Medje series 4 skulls exceed 19 mm. (19.1-19.8) in length, and all but two reach or exceed 10 (10-10.6) in zygomatic breadth. The minimum of the Medje series equals the minimum

of the Avakubi series, but the maximum of the former is 0.5 to 0.8 mm. greater than the maximum of the latter. There is, however, no appreciable difference in coloration, and the two localities are less than seventy miles apart and in similar environment.

The 3 specimens from Aba agree in size with the Medje specimens. A single specimen from Leopoldville agrees in every way with the Avakubi specimens, but the 3 from Aba, the 4 from Faradje, and the 3 from Poko agree in size with the Medje series, but in some of the Faradje and Poko specimens the pelage is intense orange rufous, both above and below (a little lighter and more intense below than above).

The pelage above in all the skins is brown basally with a lighter intermediate zone and dark rufous tips; below, the base of the pelage is dark brown with long intense reddish orange tips.

All the specimens here referred to *H. caffer centralis* come from well within the range assigned to *centralis* by K. Andersen in his elaborate review of the *H. caffer* group,<sup>1</sup> and also conform satisfactorily to his definition of this form. It is possible, however, that the Leopoldville and Avakubi specimens should be referred to Andersen's *H. caffer angolensis*, and only the more northern examples from Medje, Poko, Faradje and Aba to *H. c. centralis*.

### 23. *Hipposideros caffer niapu* subsp. nov.

Type, No. 49414 (alcoholic), ♂ ad., Niapu, Belgian Congo, Jan. 27, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2322.

Similar in general coloration to *H. caffer centralis*, but much larger; it has a dark phase and a rufous phase, like the other forms of the *caffer* group.

Type (in rufous phase), upperparts uniform chestnut-brown; underparts cinnamon-brown; ears and membranes dark brown.

In the dark phase the upperparts are hair-brown, below lighter, with the tips of the hairs lighter than the basal fur. Most of the specimens are in the dark phase, which is similar to the corresponding phase of *H. caffer centralis* and *H. abæ*, but none of the specimens in the rufous phase approach nearly to the intensity of coloration seen in many examples of either of these forms.

Measurements: Type, total length, 88; head and body, 58; tail, 30; tibia, 21.8; foot (c. u.), 10.8; ear,  $11.2 \times 14.5$ . Forearm, 54.5. In the ten topotypes (including type) the forearm averages 54.7 (53–56).

Skull (type), total length, 20.3; condylobasal length, 17.8; zygomatic breadth, 10.6; mastoid breadth, 10.2; interorbital breadth, 2.9; maxillary breadth, 6.8; breadth at base of canines, 4.8; maxillary tooththrow (c-m<sup>3</sup>), 66; length of mandible,

<sup>1</sup> On *Hipposiderus caffer*, Sund., and its closest Allies; with some Notes on *H. fuliginosus*, Temm. Ann. and Mag. Nat. Hist. (7), XVII, pp. 269–283, March, 1906.

12.4; mandibular tooththrow, 7.2. Four male topotype skulls<sup>1</sup> (including type), total length, 20.1 (19.8–20.3); zygomatic breadth, 10.5 (10.3–10.6); interorbital breadth, 2.9 (2.8–3); length of mandible, 12.4 (12.2–12.5).

*H. caffer niapu* seems clearly to represent a large race of the *caffer* group, larger than any hitherto described. In Andersen's table of measurements of the forms of the *caffer* group,<sup>2</sup> based on 98 specimens (including 75 skulls), the maximum length of the forearm is given as 53.8 for 24 specimens of *centralis*, as against 54.7 in 10 specimens of *niapu*, while the maximum in 40 specimens of typical *caffer* is 51.8. He gives (*l. c.*, p. 276) the average forearm length for 40 specimens of *H. caffer caffer* as 48.6, and for 50 specimens of *centralis-guineensis* (which do not differ in size) as 50.6, as against 54.7 in 10 specimens of *niapu*, the latter exceeding the *centralis-guineensis* series by 4 mm. The skulls bear out the evidence of larger size for the *niapu* series, in which the average total length of the skull is 1 mm. greater than in the *centralis-guineensis* series, which is equal to the average difference between the latter and typical *caffer*.

*H. c. niapu* is represented by 10 adult specimens (6 males, 4 females), all from the type locality, and all collected the same day. It is clearly specifically different from the much larger *H. abæ* described below from a series of 35 skins and skulls, all from Aba, and all collected also during one day.

#### 24. *Hipposideros abæ* sp. nov.

Type, No. 49123, ♂ ad. (skin and skull), Aba, Uele district, Belgian Congo, Dec. 13, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1715.

Upperparts (type, an average specimen of the dark phase) heavily washed with bistre from the shoulders posteriorly; lighter anteriorly through the shorter dark tips of the hairs, which nearly disappear on sides of head, neck and shoulders, which are thus much lighter than the back; underparts buffy gray, much lighter on throat; ears light brown, rather small, tip obtusely rounded; feet and ventral surface of limbs light brown; membranes dark brown.

Type, total length (collectors' measurements), 104 mm.; head and body, 66; tail, 38; foot, 12; ear (from outer base), 20. Forearm (from skin), 58.5; tarsus, 23.2; foot, 11; ear (from inner base), 16.

Skull (type), total length, 23; zygomatic breadth, 13; width of braincase, 11; maxillar breadth (across m<sup>3</sup>), 8.8; breadth at base of canines, 6.1; upper tooththrow (c-m<sup>3</sup>), 8.2; length of mandible, 14; lower tooththrow, 9.4.

Posterior border of nose-leaf rounded; three secondary cutaneous leaflets, the outer one slightly developed; a frontal sac in the males, absent or much less devel-

<sup>1</sup> Selected at random for removal from a series of 10 alcoholic specimens, the series as a whole varying but 3 mm. in the length of the forearm.

<sup>2</sup> Ann. and Mag. Nat. Hist. (7), XII, p. 282, March, 1906.



oped in females. P<sup>2</sup> uniformly present on both sides in each of the 35 skulls, inserted on the outer border of the tooththrow, closely crowded in between the canine and p<sup>3</sup>.

Represented by 35 specimens (16 males, 19 females, all adult, skins with perfect skulls), all taken at Aba, December 13, 1911.

The collectors' measurements from the fresh specimens (16 males, 19 females), are as follows:

	Total length	Head and body	Tail	Foot	Ear
♂	101.2 (97-107)	65.5 (60-70)	34.2 (32-39)	12 (11-13)	21.4 (20-22)
♀	101.4 (95-105)	65.4 (60-70)	36 (32-40)	12.2 (11-13)	21.5 (20-22)

The forearm and skull measurements (total length and zygomatic breadth) of the same specimens:

	Forearm	Skull
♂	58 (56-60)	23.1 (22.5-23.7) × 13.4 (13.1-13.9)
♀	57.8 (54-60.5)	22.7 (21.9-23.3) × 13.2 (12.6-13.7)

This large series of specimens, all taken the same day at the same locality, and also all fully adult, is especially interesting from the wide range of color variation it presents, which, as shown by the skulls, is wholly independent of age, and probably of sex, although of the 16 specimens in the red phase 11 are females and 5 are males, and none of the males are nearly as red as are the majority of the red phase of the females. The dark phase, on the other hand, includes 11 males, while only 8 females can be assigned to it; and only two of the dark males are strictly referable to the norm of the dark series of females, the others being distinctly intermediate between the dark and red phases.

The *dark phase* may be described as follows: Upperparts, in general effect, washed with drab-brown, lighter on the neck and shoulders, whitish prevailing on the sides of the shoulders; fur at extreme base dusky, with a broad intermediate zone of whitish, the tips of the hairs dark drab-brown, giving a dark brown superficial tone to the dorsal aspect. The extent of the dusky tipping varies greatly in different specimens, and may be almost absent over the shoulders and especially on the sides of the shoulders, giving there a prevailing whitish tone. In general the white middle zone of the fur shows more or less at the surface. Underparts uniform dingy pale buff with a faint superficial wash of yellowish. Basal portion of the fur very pale brown, showing more or less through the pale buffy tips.

*Red phase.* Upperparts cinnamon-brown, often darkening on the middle of the back to nearly chestnut-brown. Fur at extreme base slightly darkened, the broad middle zone pale cinnamon, the tips of the hairs dark ruddy brown; sides of shoulders light yellowish white. The underparts vary in different specimens from pale buffy to deep reddish ochraceous; in average female specimens, pale ochraceous. This is the 'red' phase as

shown in females; the males in the red phase are much less rufous, both above and below, the upperparts being of a much darker and less reddish tone, and the ventral surface is seldom brighter (yellowish buff).

Many of the males and some of the females are so nearly intermediate between the two phases that it is difficult to assign them satisfactorily to either. None of the specimens is young enough to indicate the character of the immature or juvenile pelage.

*Hipposideros abæ* is allied to the *H. caffer* group, from which it differs in considerably larger size, and lighter and more buffy underparts. *H. caffer centralis* occurs with *H. abæ* at the type locality of the latter. Average length of forearm in *H. abæ* (35 specimens), 58 mm.; of *H. caffer centralis*, 50; total length, *H. abæ*, 101, *H. c. centralis*, 92. Skull, *H. abæ*,  $23 \times 13.3$ ; of *H. c. centralis*,  $18.5 \times 10$ .

## 25. *Hipposideros nanus* sp. nov.

Type, No. 49426 (alcoholic), ♀ ad., Faradje, Uele district, Belgian Congo, Oct. 24, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1689.

A very small species of the *H. beatus* type.

Upperparts dusky brown, the hairs dark at base and tips with a broad median zone of white; underparts lighter, the hairs with grayish tips; ears and membranes dark brown.

Total length, 68 mm.; head and body, 46; tail, 22; forearm, 43.4; third metacarpal, 31; tibia, 16.5; foot, with claws, 7.9; ear, length, 9.2, width, 12; greatest breadth of horseshoe, 5; of posterior leaf, 5.5.

Skull, total length, 16.2 (16.8)<sup>1</sup>; zygomatic breadth, 8.2 (9.7); mastoid breadth, 8.5 (9.2); maxillary breadth, 5.5 (7), breadth at base of canines, 4.5 (4.3–4.7); mandible, 9.5 (10.7–11.3); upper tooththrow (c–m<sup>3</sup>), 5.2 (5.9–6.2); lower tooththrow, 5.7 (6.2–7).

Represented by only the type.

*Hipposideros nanus* is nearly related to *H. beatus* Andersen (*l. c.*, p. 279), from near Benito River, Guinea, and may be considered as its geographical representative in the Uele district of northeastern Belgian Congo.

## 26. *Hipposideros langi* sp. nov.

Text Figs. 4–6.

Type, No. 49098 (skin and skull), ♂ ad., Avakubi, Jan. 24, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2481.

A large species, with long, soft, woolly pelage, allied in general features to *Phyllostoma cyclops* Temminck.

<sup>1</sup> The measurements in parentheses are the corresponding measurements of 2 skulls of *H. beatus* as given by Andersen, Ann. and Mag. Nat. Hist. (7), XVII, p. 281, March, 1906.

Upperparts, in general effect, blackish grizzled with white, the pelage being brownish black at base and apically with a narrow subapical zone of white; head grayish brown, much lighter than the back, with dusky eyerings; underparts uniform dusky brown, the tips of the hairs lighter, giving a decidedly grayish general effect, considerably lighter than the back. Proximal half of forearm heavily furred. Ears and membranes naked, blackish brown, the wing and leg bones and the feet much lighter than the membranes, especially on the ventral aspect.

Ears narrow and attenuate, tapering apically to a sharp point. Interfemoral membrane deeply hollowed; tail very short, about one-third of the length of head and body, the terminal vertebra free. Thumb short. A large frontal sac in both sexes, lined with silky straight hairs, wholly white, or white at base with light brown-

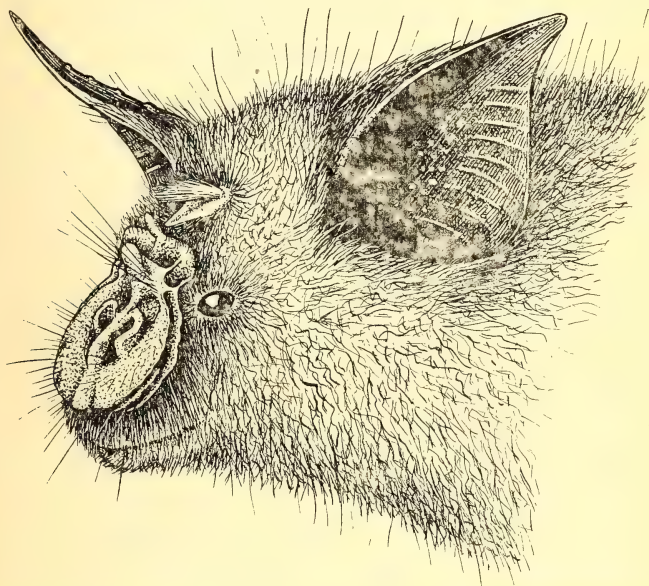


Fig. 4. *Hipposideros langi*. Head of adult male (No. 49391), showing nose-leaves and frontal sac.  $\frac{2}{1}$ .

ish tips. When the sac is everted these white hairs form a conspicuous white tuft. A glandular pouch is present in males just in front of the anus, lined with long, rusty brown bristly hairs, which when the pouch is everted form a conspicuous tuft, the hairs being more or less obvious even when the pouch is not everted. The females appear to lack the anal pouch, but have in its place a pair of elongated nipple-like papillæ, usually clubshaped or thickened apically. These are conspicuous in alcoholic specimens and usually readily observed in dry skins. They are situated about 5 mm. apart and have a length of about 8 mm.

Nose-leaf very broad (about 20 mm. wide); posterior leaflet narrow (about 10 mm. wide), with a narrow central point 2 mm. high and 0.5 mm. wide. The nostrils are enclosed posteriorly and laterally by a fleshy conch-shaped border. There is a prominent fleshy knob at the posterior border of the nose-leaf, and two supplemental leaflets, the inner strongly and the outer weakly developed.



Type, total length (collectors' measurements), 114 mm.; head and body, 87; tail, 27; foot, 20; ear, 33. Collectors' measurements of 4 adults (3 females and the male type), total length, 113 (110–116); head and body, 85.5 (83–87); tail, 28 (27–30); foot, 19.5 (19–20); ear, 33.8 (33–35).

Forearm in 10 specimens (6 skins and 4 alcoholics), 68 (66.2–68.8).

Type skull, total length, 28.1; condylobasal length, 25.1; zygomatic breadth, 14.9; mastoid breadth, 12; interorbital breadth, 2.8; breadth at base of canines, 8.4; maxillar breadth, 10.7; maxillary tooththrow ( $c-m^3$ ), 10.1; length of mandible, 18.6; mandibular tooththrow ( $c-m_3$ ), 10.9.

Six adult skulls (5 females and the male type), total length, 28.4 (28–29); condylobasal length, 25.2 (24.5–25.7); zygomatic breadth, 15.4 (14.9–15.9); mastoid breadth, 12.1 (11.8–12.4); interorbital breadth, 2.9 (2.8–3.1); breadth at base of

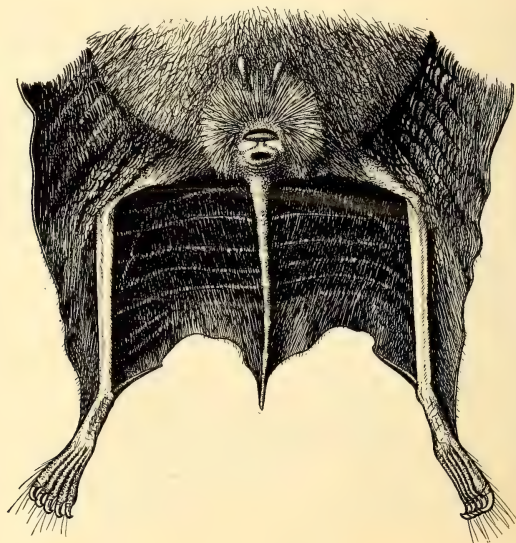


Fig. 5. *Hipposideros langi*. Pubic region of female (No. 49389).  $\frac{1}{4}$ .

canines, 7.8 (7.2–8.4); breadth of rostrum (at point of greatest inflation), 8.2 (8–8.5); maxillar breadth, 11 (10.7–11.3); maxillary tooththrow (including canine), 10.1 (9.8–10.4); length of mandible, 19 (18.4–19.4); mandibular tooththrow (including canine), 11 (10.9–11.2).

$P^2$  is minute, and stands outside of the tooththrow, the cingula of the canine and  $p^3$  being in close contact.

Posterior border of palate broadly U-shaped, with a slight median point, and extends to a line passing through the posterior border of  $m^2$ .

Represented by 14 specimens, of which 5 are alcoholic, collected as follows: Avakubi, 4, of which 3 were taken Jan. 24–26, 1914, and 1 in October, 1913; Niagara, 2, Dec. 3 and 6, 1910; Medje, 7, April 27 and Sept. 3, 1910; Niapu, 1, Oct. 28, 1914. Two of the Medje specimens are half-grown young, and two others are young

adults, not fully mature as regards size. The others are fully adult, all with perfect skulls except the Niapu specimen, of which the skull is too much broken for measurement.

The specimens represent two seasonal periods, April, and September-January. The April specimens (from Medje), in worn pelage, are browner

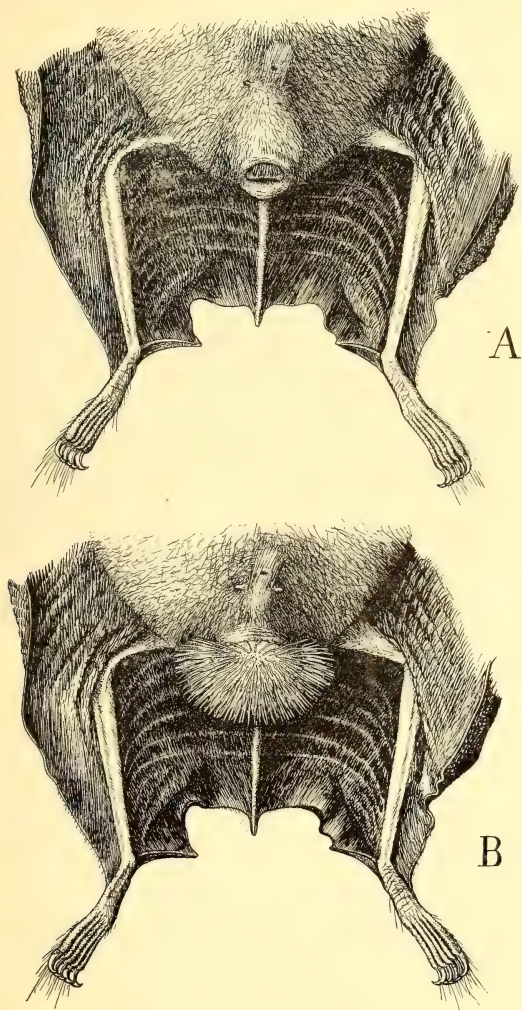


Fig. 6. *Hipposideros langi*. Pubic region of male (No. 49391). A, anal sac invaginated; B, anal sac everted.  $\frac{1}{4}$ .

and the light tips of the hairs are stained faintly yellowish in contrast with the clear blackish brown ground-color and whitish hair-tips of the Septem-

ber-October and January specimens. That the difference is probably purely seasonal is indicated by a Medje specimen taken in September, which is dark with white hair-tips, like the October-January specimens from other localities.

In its soft woolly pelage and other external features *Hipposideros langi* appears to resemble closely *Phyllorhina cyclops* Temminck, from the Boutry River, Guinea, but it is a much larger species and darker in coloration, being blackish brown with white hair-tips instead of dull brown with yellowish hair-tips. *H. cyclops*, however, appears to be little known, the only original references to it being Temminck's description<sup>1</sup> and Dobson's account,<sup>2</sup> based on two specimens, including one from the Cameroon Mountains, the other without definite locality. Neither of these descriptions is very satisfactory, the character of the skull not being mentioned in either. Dobson's measurements indicate a total length of about 93 mm., and Temminck's a total length of about 89 mm., as against an average of 113 mm. for 4 specimens of *H. langi*. Dobson gives the length of the forearm as 62.2, as against an average of 68 in 10 specimens of *H. langi*. Temminck gives the length of the forearm as 38 mm. ("antibrachium 1 pouce 7 lignes"), which is obviously an error (possibly a misprint for 2 pouces 6 lignes = 63 mm.).<sup>3</sup> The type localities of the two forms are widely separated. Dollman, however, has recorded two specimens from Avakubi (Rev. Zool. Africaine, IV, fasc., 1, 1914, p. 76), as "*Hipposideros cyclops*, Temm.," which probably are referable to the present form.

*H. langi* differs greatly from all the African species of the genus *Hipposideros* except *cyclops*, from which it is distinguishable by much larger size and darker coloration.

## 27. *Hipposideros gigas niangaræ* subsp. nov.

Plate LI, Fig. 1.

Type (and only specimen), No. 49103, ♀ ad., skin and skull, Niangara, Uele district, Belgian Congo, June 2, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2069.

A small member of the *H. gigas* group. Dorsal hair-brown Y-patch of short

<sup>1</sup> Esquisse zoologique sur la Côte de Guinée, 1853, pp. 75-77.

<sup>2</sup> Cat. Chiropt. Brit. Mus., 1878, p. 76.

<sup>3</sup> Dobson's principal measurements of a male in alcohol, from the Cameroon Mountains are: "Length (of an adult ♂), head and body 2'' .8 [71.12 mm.], tail 0'' .85 [22], ear 1'' .15 [38], nose-leaf 0'' .5 × 0'' .5 [12.7 × 12.7], forearm 2'' .45 [62.23], tibia 1'' .15 [29.2], foot 0'' .65 [16.5].

Temminck's measurements are: "Longueur du bout du museau à la pointe de la queue 3 pouces 6 lignes [about 89]; hauteur des oreilles 1 pouce [25.4]; queue 6 lignes [12.7]; envergure 12 pouces 6 a 9 lignes [about 273]; antibrachium 1 pouce 6 lignes [38], probably in error].



dense fur well defined; upperparts anterior to the Y-patch with the fur much longer and looser and of a pale brownish gray, the extreme tips of the hairs, particularly on the posterior third of this area, whitish; still paler on the top and front of the head; sides of the head lighter than the top, and joined by a narrow still lighter band enclosing the nose-leaf area; sides of back grayish posteriorly, like the anterior back, separated from the Y-patch by a whitish transverse band about 13 by 6 mm. in extent; a patch of clear white on the sides beneath the junction of the propatagium with the body and extending slightly in front of it, bounded ventrally by a band of dark hair-brown fur, a lateral extension of the dorsal Y-patch; general color of underparts yellowish gray, with a broad median band of dusky gray, the fur darker basally; ears, feet and membranes blackish. Ears long and tapering, the extreme tip slightly rounded. Membranes attached about 5 mm. above tarsal joint. Supplementary leaflets three, well-defined.

Collectors' measurements: Total length, 137 mm.; head and body, 107; tail, 30; foot, 25; ear (from outer base), 35.

Forearm (in skin), 104; third metacarpal, 72; tail, 30; lower leg, 40.5; breadth of nose-leaf, 11.7.

Skull, total length, 35.3 (39.8<sup>1</sup>); zygomatic breadth, 20 (22.2); mastoid breadth, 15.8 (18.2); maxillary breadth, 14 (14.2); antorbital breadth, 11 (11); across cingula of canines, 10.5 (11.6); mandible, 24.4 (27.8); upper teeth, 13.5 (13.8-14.5); lower teeth, 15.5 (16-16.3).

The single specimen of *H. niangarae* is a fully adult female, with a strongly developed sagittal crest, but the teeth are not appreciably worn. It has the coloration and general characters of *H. gigas*, from which it differs in much smaller size, the forearm measuring only 104 mm. as against 108-116 mm. given by Andersen (*l. c.*, p. 48) for 6 specimens of *H. gigas*<sup>2</sup>; while the total length of the skull is 35.3 as against 39.8 given by Andersen for *H. gigas*, with other skull measurements proportionally less.

The type locality of *H. gigas* is the Benito River in Angola, and the 8 specimens cited by Andersen are likewise all from Angola. The type, and apparently the only recorded specimen, of *H. gigas gambiensis* is from Gambia, in the same general region. On the other hand the type of *niangarae* is from the Uele district of the Belgian Congo, a region of quite different physical conditions and more than a thousand miles westward.

#### VESPERTILIONIDÆ.

### 28. *Myotis bocagii bocagii* (Peters).

*Vespertilio bocagii* PETERS, Journ. Sci. Math.-Phys. e Nat. Lisboa, 1870, No. 10, p. 125, Dec. 1870. Portuguese West Africa.

<sup>1</sup> The measurements in parenthesis are those given by K. Andersen for *H. gigas* (Ann. and Mag. Nat. Hist. (7), XVII, 1906, p. 48).

<sup>2</sup> The average of 4 skulls given by Andersen (*l. c.*, p. 40, last footnote) is 110.25.

A single specimen, a nearly adult male, collected at Leopoldville, July 8, 1909, is provisionally referred to typical *bocagii*. It agrees in the coloration of the upperparts with *M. b. cupreolus*, but in the coloration of the underparts differs from all the other 24 specimens of the *bocagii* group collected by the Expedition, being ashy gray without any buffy tinge instead of pale buff to ochraceous buff, as in both *cupreolus* and *hildegardæ*. That the difference is not due to immaturity is shown by perfectly comparable specimens from other localities.

29. *Myotis bocagii cupreolus* Thomas.

*Myotis bocagei cupreolus* THOMAS, Ann. and Mag. Nat. Hist. (7), XIII, p. 407, 1904. Efulen, Bulu Country, Cameroons.

Fourteen specimens (12 skins with skulls and 2 in alcohol), collected as follows: Bafwabaka, 11, Jan. 4-7, 1910; Medje, 3 (1 ad., 2 juv.), June 27, 1909.

Collectors' measurements of the Bafwabaka series (4 ad. males, 4 ad. females): Total length, 86.6 (83-90); head and body, 47 (46-50); tail, 39.6 (36-42); foot, 12 (all 12); ear, 15 (all 15).

Forearm of same specimens (in skin), 38 (37.3-38.8). Skulls of same specimens, 14.6 (14.1-15.1).

It may be worth while to note that the length of the red tips to the hairs of the back varies from 2 to 5 mm. in specimens taken at Bafwabaka on the same day, as this feature has sometimes been considered of value as a diagnostic character.

30. *Myotis bocagii hildegardæ* Thomas.

*Myotis hildegardæ* THOMAS, Ann. and Mag. Nat. Hist. (7), XIII, p. 209, March, 1904. Fort Hall, Kenya District, British East Africa. Alt. 4000 feet.

Thirteen specimens (skins, 7 with skulls), collected as follows: Aba, 11, Dec. 16-19, 1911; Faradje, 2 (1 in alcohol), March 25, 1911.

Collectors' measurements (10 specimens from Aba (6 males, 4 females): Total length, 90 (85-96); head and body, 50 (40-53); tail, 40 (38-42); foot, 11.2 (10-12); ear, 14.4 (13-16).

Forearm (same specimens), 38.6 (36.7-40.5). Skull (5 Aba specimens), total length, 14.9 (14.6-15.5).

The series of specimens from Aba averages slightly larger in all measurements than the series from Bafwabaka, referred above to *M. bocagii cupreolus*, and the coloration is much paler.

31. *Pipistrellus nanus* (Peters).

*Vespertilio nanus* PETERS, Reise nach Mossambique, I, Säugeth., p. 63, pl. xvi, fig. 2. Inhambani, Mozambique, S. lat. 24°.

Sixty-seven specimens (of which 39 are alcoholic): Stanleyville, 6 (2 alcoholic), Aug. 5-27, 1909; Risimu, 1 (alcoholic), Sept. 9, 1909; Ngayu, 4 (1 alcoholic), Dec. 14, 1909; Bafwabaka, 30 (9 alcoholic), Jan. 5-14, 1910; Gamangui, 1, Feb. 27, 1910; Medje, 6 (5 alcoholic), Oct. 7, 1910; Niangara, 9 (1 alcoholic), Nov. 11-14, 1910; Faradje, 7 (4 alcoholic), Feb. 18, 1912; Yakuluku, 1 (alcoholic), Nov. 4, 1912; Poko, 1 (alcoholic), Aug. 30, 1913; Garamba, 1, March 15, 1912.

Collectors' measurements of the Bafwabaka series (10 males and 10 females, all adult):

	Total length	Head and body	Tail	Foot	Ear
♂	74.6 (72-78)	42.6 (37-47)	32.8 (31-37)	7.0 (7-7)	11.7 (11-12)
♀	74.6 (68-79)	42.7 (37-47)	32.7 (30-37)	6.7 (6-7)	11.9 (11-12)

Forearm (from skin, same specimens) ♂ 31 (29.8-32); ♀ 31.6 (30.7-32); forearm, 6 alcoholics (3 males, 3 females) from same locality, 30.8 (29-31.5).

Collectors' measurements of the Niangara series (3 males and 6 females): Total length, 76 (74-77); head and body, 41 (38-43); tail, 35 (33-37); foot, 6.9 (6-7); ear, 10.1 (10-11). Forearm (same specimens), 30.9 (30-31.9).

The Bafwabaka and Niangara specimens are indistinguishable, either in size or coloration, and the specimens from the other localities are not distinguishable from those from Bafwabaka and Niangara.

The range of color variation in fully adult individuals is slight, the dark brown tone of the upperparts, which has a faint reddish cast, is slightly lighter in some than in others, and the same is true of the dull, pale buffy brown of the ventral surface. Immature specimens are much darker — blackish brown, in some cases nearly black.

In studying the above recorded material I have had for comparison with it seven skins and skulls (also additional skulls) from the Yala River, British East Africa, collected by H. J. A. Turner, and one specimen from Ruwenzori East, collected by R. B. Woosnam, all identified as *Pipistrellus nanus*.<sup>1</sup> These specimens are essentially the same in size and coloration as my specimens from the Congo Basin. They average slightly darker but

<sup>1</sup> Borrowed from the United States National Museum.



even the darkest examples can be matched by numerous specimens from the Congo region. The length of the forearm in the eight specimens from British East Africa averages 31.7 mm. (30.3–32.3) as against 30.8 (29–31.5) in 20 specimens from Bafwabaka, and 30.9 (30–31.9) in nine specimens from Niangara, and 30 (29–31) in three adults from Stanleyville. The corresponding measurement in the type and two topotypes of *Pipistrellus aero* Heller is 31.3 (30.5–31.5), which specimens to me appear indistinguishable from the British East Africa specimens labeled *P. nanus*.<sup>1</sup>

### 32. *Pipistrellus abaensis* sp. nov.

Type, No. 48979, ♀ ad. (skin and skull), Aba, Belgian Congo, Dec. 18, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1825.

Size of *P. nanus*, but much lighter in coloration, and with the sides of lower back broadly naked.

Upperparts light brown or pale isabella-color, the hairs nearly unicolor from base to tip; underparts pale buffy gray, the basal portion of the hairs nearly black, the tips light grayish with a slight buffy tone. Wing membranes attached to the entire length of the basal joint of the outer toe. Ear small, pointed, about equally convex on both borders.

Type, total length (collectors' measurements), 77 mm.; head and body, 44; tail, 33; foot 7; ear, 10. Additional measurements from skin: Forearm, 31.4; third metacarpal, 29.7; tibia, 12.4; foot, 6; ear 7.2. An adult female topotype is larger: Total length (collectors' measurements), 84; head and body, 53; tail, 31; foot, 8; ear, 12. Forearm (in skin), 32.1; third metacarpal, 30; tibia, 12.8; foot, 6.8; ear, 9. (The skull of this specimen, No. 48980, is lost.)

Skull (type), total length, 11.7; breadth of braincase, 6.2; interorbital breadth, 3.1; maxillar breadth, 4.6; upper tooththrow, 4; length of mandible, 8.1; lower tooththrow, 4.2. Incisors subequal in size, the inner one slightly bifid. P<sup>2</sup> exceedingly minute, inserted on extreme inner edge of tooththrow.

Represented by 3 specimens, the type and two topotypes; both of the latter lack skulls. Only two of the specimens, both females, are adult, one slightly larger than the other, but both indistinguishable in coloration. The third specimen is an immature male with the epiphyses not ankylosed but nearly adult in respect to size. It differs from the others in the pelage being nearly black above but somewhat lighter and more brownish below. All three of the specimens agree in having the sides of the lower back naked, the bare space being 5 to 6 mm. wide and 17 to 20 mm. long, extending from the base of the tail membrane anteriorly for more than half the length of the body. This feature, combined with small size, pale coloration and

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<sup>1</sup> Received at the U. S. National Museum after the publication of Mr. Heller's description of *Pipistrellus aero*.

subequal upper incisors should render the present form easily recognizable. As said above, it is about the size of *P. nanus*, from which it differs strikingly in coloration, in the shape of the ears, and in the character of the upper incisors and upper premolars. It does not appear closely related to any described species.

33. **Pipistrellus musciculus** *Thomas.*

*Pipistrellus musciculus* THOMAS, Ann. and Mag. Nat. Hist. (8), XI, p. 316, March, 1913. Biteye, Ja River, S. E. Camaroons. Alt. 2000 feet.

One specimen, adult female, in alcohol, Avakubi, Feb. 26, 1914. Forearm, 25.2; skull, total length, 11; zygomatic breadth, 7.7.

34. **Scotozous rüppelii** (*Fischer*).

*V[espertilio] rüppelii* FISCHER, Synop. Mamm., 1829, p. 109. Dongola.

One specimen, adult male in alcohol, Poko, August, 1912.

Forearm, 31.3. Skull, total length, 13.1; condylobasal length, 12.5; zygomatic breadth, 9.3; breadth of braincase, 7.2; upper tooththrow ( $c-m^3$ ) 4.5; length of mandible, 8.6; lower tooththrow ( $c-m_3$ ), 5.1.

35. **Eptesicus tenuipinnis** (*Peters*).

*Vesperus tenuipinnis* PETERS, Monatsb. Akad. Berlin, 1872, p. 263. Guinea.—NOACK, Zool. Jahrb., IV, 1889, p. 218. Kuilu-Fluss, Lower Congo district.

Seven specimens (4 skins and skulls, 3 alcoholic), Ngayu, near Avakubi, December, 1909.

Collectors' measurements (1 male, 3 females): Total length, 71 (68–73); head and body, 42 (40–44); tail, 29.5 (28–31); foot, 8 (8–8); ear, 11.5 (11–12).

Forearm (from skins), same specimens, 28.8 (27.9–29.4); two adults in alcohol, male 27.5, female 28. Skulls (four specimens), total length, 12.2 (11.9–12.9); breadth of braincase, 6.2 (6–6.3).

In this series the ears are white; the hairtips on the upperparts are slightly silvery yellowish in two specimens, nearly absent in the other two. Membranes pale yellow in dry skins, pure white in alcoholic specimens.

36. **Eptesicus ater** sp. nov.

Type, No. 48988, ♂ ad., skin and skull, Faradje, March 1, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1466.

Similar in general appearance to *E. tenuipinnis* but smaller, with black ears and feet, and wholly black above.

Pelage of upperparts brownish black to base of hairs, which are without light tips; below the hairs of foreneck and upper chest brownish black tipped with whitish, rest of lower parts clear white, the hairs dusky at base; wing membranes white above and below; interfemoral membrane brownish white above, paler below; ears, feet, tail and limb bones dark brown, in strong contrast with the light-colored membranes. Size and general structure, including ears and tragus, as in *E. tenuipinnis*.

Collectors' measurements of type: Total length, 68 mm.; head and body, 39; tail, 29; foot, 6; ear, 12. Forearm (from skin), 27.5; in an adult male topotype, 27.9; in two subadult specimens from Niangara, ♂ 27, ♀ 25.

Skull, type, total length, 12.2; condylobasal length, 11.6; zygomatic breadth, 7.5; breadth of braincase, 6.6; interorbital breadth, 3.4; maxillar breadth, 5.2; breadth at base of canines, 4; length of upper tooththrow ( $c-m^3$ ), 4; length of mandible, 8.4; angle to condyle, 1.5; depth at coronoid, 2.5.

Represented by 4 specimens: Faradje, 2 (type skin and skull and alcoholic topotype); Niangara, 2 (subadult skins with skulls).

*E. ater* is nearly related to *E. tenuipinnis*, from which it differs in the much darker coloration of the pelage, the ears and feet blackish instead of pale yellow, and in slightly smaller size.

### 37. *Eptesicus faradjius* sp. nov.

Type, No. 49045, ♀ ad., skin and skull, Faradje, northeastern Belgian Congo Feb. 21, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1914.

Upperparts tawny olive, the hairs dusky at extreme base; underparts similar but much paler, the tips of the hairs light tawny on throat, breast and middle of belly, more fulvous on side and pubic region; ears pale brown; limb bones and interfemoral membrane light brown above, paler below; wing membranes pale yellow on both surfaces.

Collectors' measurements of type: Total length, 93; head and body, 59; tail, 39; foot, 8; ear, 11. Forearm (from skin), 33.

Collectors' measurements of ten topotypes (5 males, 5 females): Total length, ♂ 88 (83-95), ♀ 92.6 (90-96); head and body, ♂ 51 (46-56), ♀ 54.2 (52-56); tail, 37 (35-38), ♀ 39 (35-43); foot, 8.4 (8-9), ♀ 8.4 (8-9); ear, ♂ 11.4 (11-12), ♀ 11.4 (11-12). Forearm (same specimens), ♂ 33.5 (32.5-35.6), ♀ 34.9 (32.5-36.2).

Skull (type), total length, 13.8; condylobasal length, 13; zygomatic breadth, 8.8; breadth of braincase, 7; mastoid breadth, 8.2; interorbital breadth, 4; maxillar breadth, 6.1; breadth at base of canines, 4.9; upper tooththrow ( $c-m^3$ ), 4.6; length of mandible, 10.2; angle to condyles, 1.8; depth at coronoid, 3.2; lower tooththrow, 5.3. Skull, 9 topotypes (4 males, 5 females): Total length, ♂ 13.5 (13.2-13.9), ♀ 13.7 (13.4-13.7).

Represented by 24 specimens: 14 (topotypes) from Faradje, collected February 18-21, March 1-30, and August 2, 1911, and 10 from Niangara, collected November 16-December 26, 1910.



The two series are indistinguishable in every respect. Each series, however, shows a considerable range of variation in color, some of it due to age but mainly purely individual, the fawn color of the upper parts varying greatly in tone in different specimens, independently of sex and age.

There is apparently a slight sexual difference in size, the females having the forearm averaging about 2 mm. longer than the males, and there is a corresponding but slighter average difference in the length of the skull.

*Eptesicus faradjius* appears to be related to *E. flavescens* (Seabra), but it is smaller than the latter and should be readily distinguishable from it by the deep fawn color of the upperparts (varying in different specimens from light yellowish to olivaceous and even to slightly rufescent in different specimens), combined with a forearm length of about 34 mm. as against 37 in *flavescens*.<sup>1</sup> It is very different in coloration from *E. phasma*, with a large series of which it has been compared, and with which it closely agrees in size.

### 38. *Eptesicus minutus minutus* (Temminck).

*Vespertilio minuta* TEMMINCK, Mon. Mammal., II, 1835-41, p. 209. "Elle vit . . . dans plusieurs parties de la pointe méridionale de l'Afrique."

Two specimens in alcohol, both adult males, appear referable to this species: Niangara, 1, March 27, 1913; Isiro, 1, July 3, 1913.

Forearm, Isiro specimen, 28.5; Niangara specimen, 28.2. Skull, Isiro specimen, total length, 12; zygomatic breadth, 8.5; mastoid breadth, 7.3; upper toothrow (c-m<sup>3</sup>), 4. The skull of the Niangara specimen is too fragmentary for measurement.

### 39. *Eptesicus garambæ* sp. nov.

Type (and only specimen), No. 49340, ♂ ad. in alcohol, Garamba, March 14, 1912; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1888.

Upperparts very dark brown, the hairs without appreciably lighter tips; underparts similar but slightly paler, the tips of the hairs faintly grayish; membranes naked, blackish with a very narrow whitish edging; inner surface lighter and slightly grayish; lower surface of limb bones whitish, in strong contrast with the dark membranes; wing membranes from base of outer toe; last caudal vertebra free for half its length; proximal vertebrae slightly hairy.

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<sup>1</sup>The external measurements of 13 specimens of *flavescens*, as given by Seabra are: Total length, 117 (111-126), in 10 specimens of *faradjius*, 90 (83-96); head and body (*flavescens*), 85 (81-90), in *faradjius*, 52.6 (46-56); tail in *flavescens*, 33 (30-36), in *faradjius* 36 (35-43). Cf. Seabra, Jorn. Sc. Math.-Phys. e Nat. Lisboa (2), VI, p. 125, Feb. 1900.

Total length, 77.6 mm.; head and body, 44.6; tail, 33; forearm, 33; third metacarpal, 31.3; tibia, 12.6; foot, 9.1; ear from crown, 7.7; from notch, 12; length of tragus, 5.8.

Skull, total length, 13.7; condylobasal length, 13.1; zygomatic breadth, (?); mastoid breadth, 7.6; interorbital breadth, 4.7; breadth of braincase, 6.7; maxillar breadth, 5.4; breadth at canines, 4; upper toothrow (c-m<sup>3</sup>), 4.5; length of mandible, 9.4; angle to condyle, 1.7; depth at coronoid, 3.4; lower toothrow, 4.8.

*Eptesicus garambae*, in size and external characters, resembles *E. ugandæ* Hollister, from Ledgus, Uganda, but exceeds it considerably in size, and differs from it in the form of the tragus and other characters, the last caudal vertebræ extending half its length beyond the membrane instead of wholly enclosed within it as in *ugandæ*. The skull proves, on comparison with topotype skulls of *ugandæ*, to not only exceed it greatly in size, but is much broader and flatter, and the rostral portion much broader, the skull as a whole much more massive and depressed.

#### 40. *Mimetillus moloneyi* (Thomas).

Text Fig. 22 A (p. 537).

*Vesperugo* (*Vesperus*) *moloneyi* THOMAS, Ann. and Mag. Nat. Hist. (6), VII, p. 528, June, 1891. Lagos, West Africa.

Four specimens, all adult males (2 skins with skulls, an extra skull and a specimen in alcohol), collected as follows: Stanleyville, 1 (skin and skull), Aug. 25, 1909; Medje, 2 (skin and 2 skulls), June 26, 1910; Avakubi, 1 (alcoholic), Dec. 19, 1913.

Collectors' measurements of the two skins: Total length, 84, 85 mm.; head and body, 58, 58; tail, 26, 27; foot, 6, 8; ear, 13, 15.

Forearm (from skin), 27, 28.7; third metacarpal, 29, 30.6; third finger, 42.8, 44; fifth finger, 29, 30.6. Avakubi specimen (alcoholic), forearm, 28.2; third metacarpal, 28.8; third finger, 42.4; fifth finger, 30.4; foot, 6; ear from crown, 7.4, from notch, 11. (Skull badly broken.)

Three skulls, total length, 14.1 (13.8–14.3); condylobasal length, 13.7 (13.6–13.8); zygomatic breadth, 10.3 (10.2–10.3); breadth of braincase, 8.2 (8.1–8.2); upper toothrow, 4.6 (4.5–4.8).

The remarkable reduction in the size of the wings of this species, as mentioned by Thomas in his original description (*l. c.*), and later made by him the basis of the genus *Mimetillus* (Proc. Zool. Soc. London, 1862, II, p. 188), is graphically shown by Chapin in Plate LV, and is the subject of special comment in Part III, pp. 535–536, of this paper.

41. **Scoteinus schlieffenii** (Peters).

*Nycticejus schlieffenii* PETERS, Monatsb. Akad. Berlin, 1859, p. 224. Cairo, Egypt.

*Scoteinus schlieffenii* G. M. ALLEN, Bull. Mus. Comp. Zoöl., LVIII, No. 7, p. 349, July, 1914. Bados, Blue Nile.

One specimen, adult male (in alcohol), Niangara, June 20, 1913.

Forearm, 32.8 mm. Skull, total length, 14; condylobasal length, 13.6; zygomatic breadth, —; breadth of braincase, 7.1; upper toothrow ( $c-m^3$ ), 5.1.

42. **Pachyotus altilis** (G. M. Allen).

*Scotophilus altilis* G. M. ALLEN, Bull. Mus. Comp. Zoöl., LVIII, No. 7, p. 350, July, 1914. Aradeiba, above Roseires, Blue Nile, Sudan.

Two specimens, an adult female (skin and skull) and an adult male (in alcohol), Faradje, March 7, 1912.

Collectors' measurements of female: Total length, 118; head and body, 70; tail, 48; foot, 10; ear, 15. Forearm, 46.8. On the collectors' label of this specimen is written: "2 large embryos in uterus." Alcoholic, male, forearm, 46.2.

Compared with a paratype of the species from Bados, Blue Nile.

43. **Pachyotus nigrita nux** (Thomas).

*Scotophilus nigrita nux* THOMAS, Ann. and Mag. Nat. Hist. (7), XIII, p. 208, March, 1904. Efulen, Camaroons.

Two specimens in alcohol, adult females, Medje, March, 1914.

Forearm, 55.6, 56.4 mm. Skull, total length, 21.6, 22.1; zygomatic breadth, 14.6, 14.9; upper toothrow ( $c-m^3$ ), 7.2, 7.6; length of mandible, 14.4, 15; lower toothrow, 8.2, 8.4.

44. **Glauconycteris papilio** Thomas.

*Glauconycteris papilio* THOMAS, Ann. and Mag. Nat. Hist. (7), XV, p. 77, Jan., 1905. Entebbe, Uganda.

Twenty specimens (17 skins with skulls, 3 alcoholic), collected as follows: Niangara 4 (2 alcoholic), Nov. 14–16, 1910; Faradje, 13, March 14–16, 1911; Aba, 3 (1 alcoholic), Dec. 13, 1911.

Collectors' measurements of the Faradje series, 11 adults (4 males, 7



females): Total length, 103 (100–108); head and body, 54 (52–57); tail, 50 (44–53); foot, 9.4 (9–10); ear, 12.5 (11–13).

Forearm (in skin), same specimens, 42.6 (41–44.7). Skull, same specimens, total length, 13.4 (12.8–13.9); breadth of braincase, 7.8 (7.4–8.1).

Three subadult specimens have the underparts pure white instead of yellowish white as in adults, and the upperparts are wood brown instead of yellowish rufous.

45. ***Glauconycteris humeralis* sp. nov.**

Text Fig. 7, A.

Type, No. 49013, ♀ ad. (skin and skull), Medje, Belgian Congo, Sept. 7, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 956.

Size medium. A conspicuous tuft of white hairs at the shoulder. Pelage full and soft.

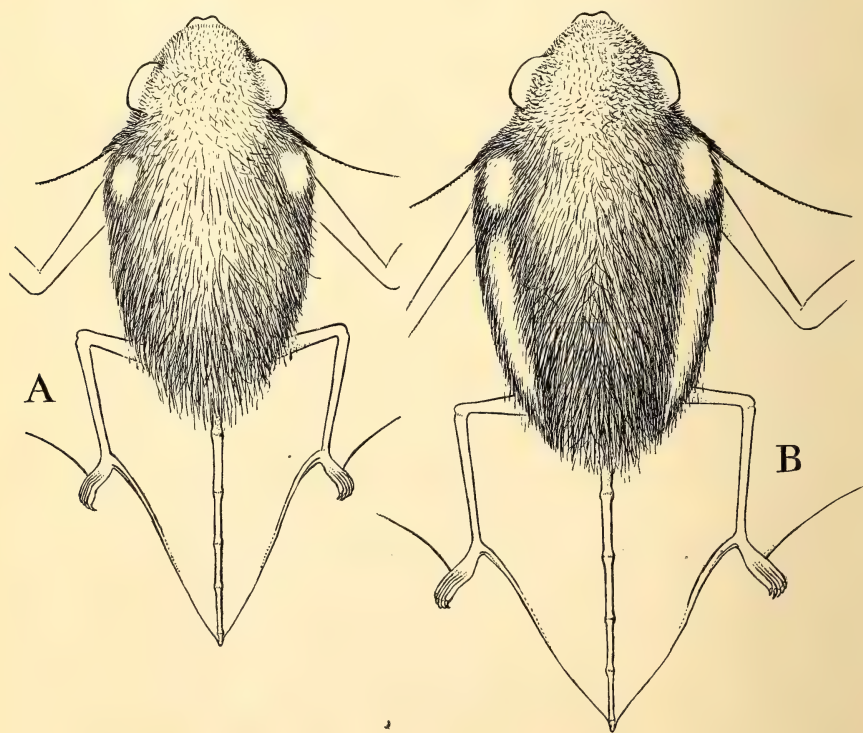


Fig. 7. Sketches of (A) *Glauconycteris humeralis*, male (No. 49315), and (B) *G. alboguttatus* sp. nov., type, female (No. 49317), to show white markings of shoulders and back.  $\frac{1}{2}$ .

Upperparts hair-brown, the hairs darker on basal half; a conspicuous tuft of white hairs on the shoulders; underparts similar to back but paler; membranes dark brown; limb bones pale brown on both surfaces; wing membranes attached to the whole length of basal joint of outer toe; no postcalcaneal lobe. Ears small, yellowish brown; tragus short, broad, straight on inner border, convex on outer border, expanded at middle. Tail wholly included in the interfemoral membrane.

Represented by 5 specimens, the type and 3 topotypes (2 of them in alcohol) from Medje, the other from Avakubi, collected Feb. 21, 1914.

Collectors' measurements of type: Total length, 82 mm.; head and body, 42; tail, 40; foot, 8; ear, 9.

Forearm, type (from skin), 36.8; third metacarpal, 35.8; tibia, 26.8; foot, 7; ear,  $5 \times 6$ ; tragus,  $3 \times 1$ . The forearm length in 2 alcoholic topotypes is, ♀ 35.8, ♀ 35.3; the Avakubi specimen, 38.8.

Skull (type), total length, 11.3; zygomatic breadth, 8.2; breadth of braincase, 7.3; interorbital breadth, 3.9; maxillar breadth, 5.1; breadth at base of canines, 3.6; upper toothrow (with canine), 3.6; length of mandible, 7.9; height at coronoid, 2.5; lower toothrow, 3.9. Skull short and very broad, the braincase greatly expanded. Inner incisor large, with the secondary column about one fourth lower than the main cusp; outer incisor inserted posterior to the inner one, minute, about one third of the height of the inner, and wedged in between inner incisor and canine. The single upper premolar is approximately the size of  $m^3$ , and quite similar to it in form.

The pure white shoulder tuft is a conspicuous feature in the type and topotypes; it is present in the Avakubi specimen, but only the tips of the hairs are white (yellowish white instead of pure white). The collectors' measurements and the forearm are somewhat larger than in the type, but the skull measurements are practically the same in all the specimens.

#### 46. *Glauconycteris alboguttatus* sp. nov.

Text Fig. 7, B.

Type, No. 49317 (and only specimen) adult female in alcohol, Medje, March 14, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2351.

Upperparts seal brown; underparts slightly paler. A patch of lengthened pure white hairs on each shoulder at base of humerus, about 8 mm. long by 5 mm. in width, separated for about 10 mm. by dark fur from a second patch of white hairs of similar extent but the area longer and narrower. They are symmetrical on both shoulders and conspicuous when the fur is floated out in clear alcohol. Muzzle, chin and sides of face nearly naked and whitish. Propatagium and outer border of wing whitish; forearm and phalangeal bones light brown above and nearly white below. Ears blackish externally, whitish internally. Membranes and feet blackish brown, interfemoral lighter below than above.

Total length, 94; head and body, 52; tail, 42; forearm, 41.5; third metacarpal, 38.6; thumb, 5.6; tibia, 18.3; foot, 8; calcar, 11; ear from crown, 7; from notch, 13; tragus, 5 mm. high by 2.5 in greatest width, broad lunate, with a small angular lobe at posterior base.

Skull, total length, 13.2; condylobasal length, 13; zygomatic breadth, 10; breadth of braincase, 7.4; interorbital breadth, 4.8; maxillar breadth, 6.5; breadth at base of canines, 4.8; upper toothrow ( $c-m^3$ ), 4.5; length of mandible, 9.5; angle to condyle, 2; depth at coronoid, 2.9; toothrow ( $c-m_3$ ), 5.2.

Similar to *Glauconycteris humeralis* but larger (the forearm 4 mm. longer and the skull fully one half larger in volume), and with two clear white spots on the shoulder (one behind the other) instead of one, and a very much broader tragus. In size it is similar to *G. congicus* (Noack) but differs from it widely in coloration.

#### 47. *Miniopterus breyeri vicini* subsp. nov.

Type, No. 49019, ♂ ad., skin and skull, Aba, northeastern Belgian Congo, Dec. 16, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1770.

Differs from *M. breyeri breyeri* in slightly smaller size and in the absence of white on the pubic region.

Upperparts dark drab, the hairs unicolor from base to tip; underparts paler, grayish drab, the hairs dark brown basally with grayish brown tips; the pubic region fulvous; ears and membranes dark brown. Limb bones ventrally light yellow brown; calcar yellowish white.

Wing membranes attached at or slightly above ankle; no post-calcar lobe. Ears very small, uniformly convex on outer and upper border, posterior border nearly straight. Tragus long, narrow, with parallel edges, 4.8 mm. long by about 1.5 mm. wide.

Collectors' measurements of type: Total length, 100 mm.; head and body, 52; tail, 48; foot, 11; ear, 11. Forearm (from skin), 43.2; third metacarpal, 40; tibia, 28; foot, 8.8; ear, length, 6.5, width, 7.5.

Skull (type), total length, 14.8; zygomatic breadth, —; breadth of braincase, 7.5; interorbital breadth, 3.8; maxillar breadth, 5.6; breadth at base of canines, 3.8; maxillary toothrow (with canine), 5.1; length of lower mandible, 10.4; height at coronoid, 3.2; lower toothrow, 6.3.

Represented by 17 specimens (skins and skulls), all adult, and all taken at Aba, Dec. 16, 1911.

Collectors' measurements, 8 males and 8 females:

	Total length	Head and body	Tail	Foot	Ear
♂	101 (94–105)	54.5 (51–59)	46.3 (43–49)	10.6 (10–11)	10.6 (10–11)
♀	103 (96–108)	54.0 (50–57)	49.0 (46–50)	10.5 (10–11)	10.7 (10–11)



Forearm, from skins, same specimens, ♂ 43.6 (42-44.7), ♀ 44.2 (43.4-44.9).

Skull, 5 males, 6 females: Total length, ♂ 14.6 (14.3-15), ♀ 14.7 (14.4-14.9); breadth of braincase, ♂ 7.4 (7.2-7.6), ♀ 7.5 (7.3-7.7).

The present form is similar in general coloration to *M. breyeri breyeri*, from the Waterberg District of the Transvaal, with two topotypes of which the present series has been compared. The pubic region is pale fulvous, however, instead of white, and the average size is considerably less, the forearm in *breyeri* having a length (3 specimens) of 46 mm. and in *vicinior* (16 specimens) 43.5, the largest specimen of the latter being smaller than the smallest of the *breyeri* specimens. Jameson<sup>1</sup> gives the length of the skull in *breyeri* as 15.5; the average in *vicinior* is 1 mm. less, only one in a series of 12 skulls reaching 14 mm.

*M. breyeri vicinior* is readily separable from the *M. natalensis* group by its paler, much browner coloration and by other features, as shown by direct comparison with typical *natalensis* and with topotypes of *natalensis arenarius*.

#### 48. *Miniopterus inflatus* Thomas.

Text Figs. 23 and 24 (pp. 540, 541).

*Miniopterus inflatus* THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 634, Dec. 1903. Efulen, Camaroons.

Thirteen specimens (9 males, 4 females, all adult, in alcohol), Thysville, Lower Congo (midway between Matadi and Leopoldville), June 2, 1915.

Forearm, 9 males, 45.2 (44.3-46), 4 females, 44.4 (44.2-44.9). Five skulls (3 males, 2 females), total length, ♂ 15.9 (all 15.9), ♀ 15.5 (15.3-15.7); zygomatic breadth, ♂ 8.63 (8.6-8.7), ♀ 8.65 (8.6-8.7). The females are slightly smaller than the males.

Pelage uniform blackish brown (nearly black) both above and below; ears and membranes dark brown, somewhat lighter colored than the body. (Figs. 23 and 24, pp. 540, 541, head of male, and left wing showing the tip folded.)

These may doubtless be safely referred to *M. inflatus*, described from an adult male skin from "Efulen, Camaroons," of which the forearm length is given as 46 mm. and the greatest length of the skull as 16.7, the latter slightly more than the largest of my series of five skulls.

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<sup>1</sup> Ann. and Mag. Nat. Hist. (8), IV, p. 471, Nov. 1909.

49. *Kerivoula cuprosa* Thomas.

Text Fig. 8.

*Kerivoula cuprosa* THOMAS, Ann. and Mag. Nat. Hist. (8), X, p. 41, July, 1912. Bitye, Ja River, southeastern Cameroons.

Three specimens: Akenge, 2, an adult female and young (the latter found hanging to the mother) in alcohol, Oct. 7, 1913; Medje, 1, adult male, skin and skull, June 7, 1914.

The collectors' measurements of the Medje specimen are as follows:

Total length, 90; head and body, 45; tail, 45; foot, 7; ear, 14. These measurements are practically identical with the field measurements of the type of the species, as given by Thomas (*l. c.*).

Measurements of the male in alcohol, from Akenge. Total length, 82; head and body, 42; tail, 40; foot, 5.7; ear (from crown), 9.3, from notch, 10.

Forearm, ♀ 34.5, ♂ 34.4; third metacarpal, ♀ 33.5, ♂ 32.8.

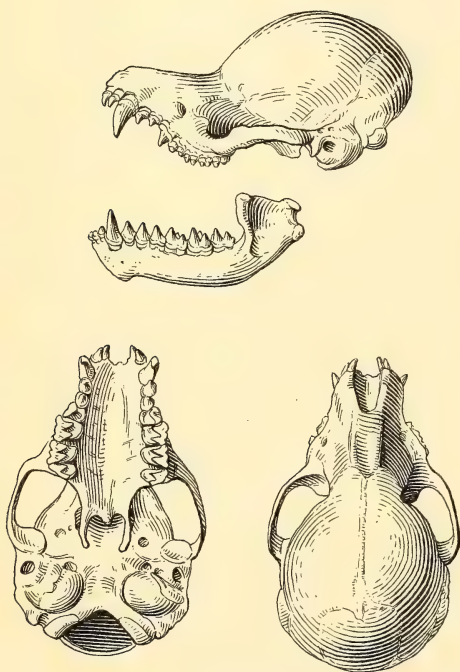
Skull, total length, ♀ 13.5, ♂ 13.6; zygomatic breadth, ♀ 12.4, ♂ 12.7; upper tooth-row ( $c-m^3$ ), ♀ 5.4, ♂ 5.2; in the type (from Thomas, *l. c.*), 5.1. The only skull measurements given of the type are those of the upper and lower toothrows.

Fig. 8. *Kerivoula cuprosa* Thomas. Skull of adult female (No. 49336).  $\frac{3}{1}$ .

In respect to coloration and other external characters these specimens agree closely with the description of the type.

The species has been previously recorded from Avakubi, near the present localities, by Dollman (Rev. Zoolog. Africaine, IV, p. 76, July, 1914).

The accompanying figures of the skull are from the female. The two skulls do not differ in any marked way, except that the male has a much more strongly developed sagittal crest.



## MOLOSSIDÆ.

50. *Myopterus*<sup>1</sup> *albatus* Thomas.

Plate LIII, Fig. 2.

*Myopterus albatus* THOMAS, Ann. and Mag. Nat. Hist. (8), XVI, p. 469. River Welle, Belgian Congo.

Seven specimens (6 skins with skulls, 1 alcoholic), Niangara, December 26, 1910. Six are adult females, the other an immature male.

Collectors' measurements of 5 adult females: Total length, 126 (123-132); head and body, 85 (80-90); tail, 41 (40-42); foot, 13.8 (13-14); ear, 23 (22-24).

Forearm (in dry skins), same specimens, 53.7 (51.5-56). Ear (from crown on midline), 14 (13.5-14.5).

Skull (same specimens), total length, 25.2 (24.2-25.7); zygomatic breadth, 14.5 (14.1-14.7).

*Myopterus albatus* was described from a skin, without skull, collected by M. Hutereau, on the Uele River, Belgian Congo (type in the Congo Museum, Tervueren, Belgium). The present specimens, from near the type locality, are confidently referred to this species. The light bands on the sides of the back are more yellowish (less whitish) than is indicated in the original description, as are also the entire underparts, and the wing membranes are pale yellow instead of "white," as described.

51. *Nyctinomus ansorgei* Thomas.

*Nyctinomus ansorgei* THOMAS, Ann. and Mag. Nat. Hist. (8), XI, p. 318, March, 1913. Malange, North Angola. Alt. 1150 m.

Twenty-six specimens (9 skins and skulls and 17 in alcohol) all taken at Faradje, February 20, 1912.

Collectors' measurements of 9 adults: Total length, 110.5 (105-115); head and body, 75 (72-79); tail, 35 (31-37); foot, 11.6 (11-12); ear, 20.9 (20-21).

Forearm, from the same 9 skins, 46 (45-47); forearm from 16 alcoholic specimens (4 males, 12 females), ♂ 46.7 (45.4-48.4), ♀ 46.4 (45.5-48).

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<sup>1</sup> On the use of *Myopterus* Geoffroy in place of *Eomops* Thomas, see Miller, Families and Genera of Bats, 1907, p. 245, and Thomas, Ann. and Mag. Nat. Hist. (8), XVI, p. 468, 1915.



Measurements of an adult male skull: Total length, 19.5; condylobasal length, 18.2; zygomatic breadth, 11.9; mastoid breadth, 10.7; breadth of braincase, 9.2; interorbital breadth, 3.9; maxillar breadth, 7.7; upper toothrow (including canine), 7.1; length of mandible, 12.8; depth at condyle, 3.7; lower toothrow, 7.8.

Average of 7 adult skulls: Total length, 19.4 (18.8–19.9); zygomatic breadth, 11.6 (11.2–12.2.)

The description of *N. ansorgei* so completely agrees with the present series that it might well have been based on any one of several of the specimens here recorded.

## 52. *Nyctinomus leonis* Thomas.

*Nyctinomus leonis* THOMAS, Ann. and Mag. Nat. Hist. (8), II, p. 373, Oct., 1908. Sierra Leone.

Two specimens, an adult female, skin and skull, Panga, Sept. 8, 1910; an adult male in alcohol, Medje, Jan. 25, 1910.

Collectors' measurements of the female from Panga: Total length, 106 mm.; head and body, 74; tail, 32; foot, 11; ear, 17. Forearm (from skin), 39.4.

Skull, total length, female 18.7, male 20; condylobasal length, 17.3, 18; zygomatic breadth, 12, 12.4; mastoid breadth, 10.6, 11.2; interorbital breadth, 3.7, 4; maxillar breadth, 8.6, 8.4; breadth at base of canines, 5.3, 5.8; length of upper toothrow (with canine), 6.9, 7.1; length of mandible, 12.9, 12.9; depth at condyle, 3.5, 4.7; length of lower toothrow, 7.5, 8.2. First lower premolar about half the size of the second.

Female skin: above dark chocolate brown, almost blackish brown, the hairs lighter at base; throat pale yellow; sides pale brown; rest of lower parts pale yellowish white. Ears and membranes deep black. A short narrow band of dark brown fur at junction of forearm and humerus. Edge of upper lip conspicuously furrowed, the anterior grooves about 3 mm. in length.

The skull has the sagittal and lambdoid crests well developed, much heavier in the male; the strong development and backward extension of the lambdoid strongly suggests the condition of the occipital region in *Allomops*, as does also the larger size of the male as compared with the female.

These specimens are doubtfully referred to *N. leonis* (type locality, Sierra Leone). Both have a tuft of lengthened black hairs on the front of the crown, close to the base of the connecting membrane of the ears, the longest of which in the male have a length of 10 mm.

53. *Nyctinomus cisturus* Thomas.

*Nyctinomus cisturus* THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 502, Nov. 1903. Mangala, east bank of Nile, 25 miles north of Gondokoro, Kordofan.

One specimen, No. 48842, subadult male, skin and skull, Niangara, Dec. 10, 1910.

This specimen agrees so completely with the description of *N. cisturus* (type locality, Mangala, 25 miles north of Gondokoro on the upper Nile River), that it may be confidently assigned to this species, although the presence of the large anal gland, noted in the description of the unique type, cannot be positively determined from the skin.

Collectors' measurements: Total length, 128 mm.; head and body, 95; tail, 33; foot, 12; ear, 19. Forearm (from skin), 46.6.

Skull, total length, 19.5; condylobasal length, 17.8; zygomatic breadth, 11.5; mastoid breadth, 10.6; maxillar breadth, 8; breadth of braincase, 9.3; upper toothrow ( $c-m^3$ ), 6.8.

Above dark brown; below similar, without white on the median line, but with a narrow edging of white at base of wing membranes between humerus and femur. Wing membranes above blackish brown proximally, lighter brown and translucent beyond the fourth digit.

54. *Nyctinomus ochraceus* sp. nov.

Type, No. 48821, ♀ ad. (skin and skull), Medje, March 16, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 745.

Ears thick, united at base in front. Coloration unusual for a molossid.

Above, superficially, dark chestnut-brown, the hairs ochraceous-buff basally, showing more or less at the surface, especially on the shoulders and sides of the neck where it often gives the prevailing tone to the coloration; below orange, varying in tone in different specimens from pale to deep orange. A tuft of lengthened dark chestnut-colored hairs on the front part of the crown behind the connecting membrane of the ears. Ears blackish brown. Membranes naked; wing membranes from upper part of tibia; face naked, brownish. Interfemoral membrane narrow, much more than half the tail free. Tragus small, narrow and pointed, a little higher than wide. Antitragus low, evenly rounded above, broader at base than high, about  $5.5 \times 4.5$  mm.

Collectors' measurements of type: Total length, 105 mm.; head and body, 72; tail, 33; foot, 11; ear, 18. Forearm (in skin), 37.7.

Collectors' measurements of type and 16 topotypes; Total length, 103 (100-106); head and body, 71.6 (68-73); tail, 31 (29-34); foot, 11 (all 11); ear, 17.5 (17-19).

Forearm, same specimens, 38 (37.3-39.3).

Skull (type), total length, 18.6; condylobasal length, 16.6; zygomatic breadth, 11.7; mastoid breadth, 10.8; breadth of braincase, 9; maxillar breadth, 8.3; inter-

orbital breadth, 4; breadth at base of canines, 5.6; length of upper toothrow (with canine), 6.7; length of mandible, 12.2; angle to condyle, 3.6; depth at coronoid, 3.1; length of lower toothrow, 7.4.

Skulls of type and 16 topotypes, total length, 18.8 (18.2–19.4); zygomatic breadth, 12 (11.4–12.5).

Braincase low and flat, sagittal and lambdoid crests slightly developed, the latter indicated only in old adults; preorbital process absent or barely indicated. Pre-maxillæ emarginate behind base of incisors. Upper incisors small, slightly convergent apically, widely separated from each other and the canines. First upper premolar very small, in midline of toothrow and not crowded between the adjoining teeth. Lower incisors 2–2, small, crowded in a convex row between canines. First lower premolar about half the size of the second. Coronoid process small and low, barely reaching the level of the condyles, and directed outward.

This striking species is represented by 22 specimens, 18 skins with skulls and 4 in alcohol, all taken the same day at Medje, and all adult. Only 4 are males, and of the 14 female skins 11 are labeled as “carrying an embryo in right uterus.” One of the alcoholic specimens is in poor condition, the ears and membranes being abraded and light colored, and the orange of the underparts is faded to pale yellow. This specimen was taken at first to represent a different but (owing to its condition) an unidentifiable species, and was so listed in this paper, but Mr. Lang assures me that this is one of the 22 specimens of *N. ochraceus* taken at Medje, all on the same day, and that its present abraded and bleached condition is due to bad preservation due to an accident in transportation.

*Nyctinomus ochraceus* appears to be related to *N. thersites* Thomas but it is smaller (forearm 38, in *thersites* 41; skull  $18.8 \times 12$ ; in *thersites*  $20 \times 12.5$ ), and the lower premolars are not subequal as in *thersites*. *N. thersites* is described as “colour dark brownish chestnut, the glandular hairs behind the junction of the ears black.” This applies fairly well to the upperparts of *N. ochraceus*, except that the lengthened hairs behind the ears in males are not black but dark chestnut. It is hardly possible, however, that this brief description could apply if the lower parts had been ochraceous-orange, as in the species here described.

### 55. *Chærephon frater* sp. nov.

Type, No. 49275, ♀ ad. (alcoholic), Malela (near Boma), southwestern Belgian Congo, July 8, 1915; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2613.

Similar to *Chærephon hindei* in general coloration but smaller, skull less massive and the dentition weaker, with  $p^2$  much smaller.

Coloration, including the wing membranes, practically the same as in *C. hindei*, so far as can be determined from alcoholic material, except that the proximal border



of the wing membranes, between the humerus and femur, is without the white band of fur seen in *hindei*.

Entire body dark brown except a band, usually well-defined pure white median area from opposite the shoulders to base of tail, covering about one-third of the ventral surface of this part of the body, varying somewhat in extent in different specimens. Wing membranes white above, except proximally from elbow to knee where they are brownish, the tone deepening toward the body; below wholly white. Interfemoral membrane brown both above and below. Ears joined by a deep membrane, fringed above with short stiff hairs about 0.5 to 1 mm. in length, and similarly covered in front and on the central part of its posterior face. Tragus minute, quadrate, about 1 mm. square. Antitragus rounded above, about 2.5 mm. in height and about 3 mm. wide at base. In 18 of the 22 well-preserved alcoholic specimens the front half of the crown behind the membrane joining the ears is naked; in the other four this area is slightly covered with fine fur. The ears are thinner and broader than in *C. hindei*.

External measurements of the type: Total length, 80 mm.; head and body, 50; tail, 30; forearm, 37; third metacarpal, 35.5; thumb to base of the prominent pad, 6; tibia, 10.5; foot, 7.2; ear from crown, 8.7; from the notch behind the antitragus, 12. Forearm, average of 22 topotypes, 36 (35-37). Forearm in type of *hindei*, 40; in five specimens from near the type locality, 37.6 (37-39.4).

Skull, type (corresponding measurements of type of *hindei* in parenthesis): Total length, 15.2 (17.6); zygomatic breadth, 9.4 (11.4); upper toothrow, 5.4 (6.7).

Seven skulls (removed from alcoholic specimens), 1 male and 6 females, measure as follows: Total length, 15.9 (15.4-16.4); condylobasal length (4 skulls), 14.3 (13.8-14.8); zygomatic breadth, 9.5 (9.0-9.9); mastoid breadth, 8.9 (8.7-9.2); breadth of braincase, 8.3 (7.9-8.4); interorbital breadth, 3.4 (3.3-3.6); breadth at base of canines, 4.2 (3.6-4.5); maxillary breadth, 6.8 (6.4-7.8); upper toothrow (c-m<sup>3</sup>), 5.4 (5.2-5.6); length of mandible, 10.1 (9.5-10.6); angle to condyle, 2.5 (2.3-2.9); depth at coronoid, 2.6 (2.2-2.9); lower toothrow (c-m<sub>3</sub>), 5.9 (5.6-6.1).

Represented by 22 specimens in alcohol, all from Malela, the type locality.

Six skulls of *C. hindei*, two from the type locality (Fort Hall, B. E. Africa) and three from a nearby point (collection of United States National Museum) measure as follows (the corresponding measurements of six skulls of *C. frater* are given in brackets): Total length, 17.5 (17.3-18) [15.9 (15.4-16.4)]; zygomatic breadth, 10.6 (10.5-10.8) [9.5 (9.2-9.9)]; length of mandible, 11.4 (11.2-12) [10.1 (9.5-10.6)]. A single skull from Mombasa (collection of Museum of Comparative Zoölogy), exactly agrees in measurements with the average of the five from the Fort Hall region.

In general form the skull is a miniature of that of *C. hindei* but disproportionally weaker, especially in respect to the mandible and dentition. In four of the seven skulls examined, the premaxillæ are fully ossified, as in typical *Chærophon*; in the others there is a U-shaped vacuity behind the incisors and the incisors are not united by an osseous border. In this species, as in *C. abæ* and some other species of *Chærophon* of which I have been able to examine a series of skulls, a similar condition exists, the younger specimens often having the premaxillæ imperfectly ossified at the incisive border. In one skull p<sup>2</sup> is in the toothrow on the left side, but on the right

side is on the outer edge of the toothrow, as it is on both sides in all of the other five skulls. Usually  $p^2$  separates the canine from  $p^4$ , but in two instances  $p^2$  is crowded so far out that the canine and  $p^4$  are in contact. The first lower premolar is about one-third smaller than  $p_4$ .

The nearest known form to *C. frater* is *C. hindei* (type locality, Fort Hall, Kenya district, British East Africa), from which *frater* differs in smaller size, especially in the smaller size of the skull and much weaker dentition. It also differs in color, particularly in having a larger area of white on the middle of the belly and in the absence of white on the proximal border of the wing membranes. As shown above, in a series of six skulls of each form, the extreme measurements do not overlap, the smallest *hindei* skull being considerably larger than the largest *frater* skull. The males of *hindei* have a low broad tuft of dark hair behind the membrane joining the ears, arising from the front part of the crown (not from the back of the frontal membrane, as in *Lophomops*), but in *frater* this part of the crown is usually bare in both sexes, and hence of course without the frontal tuft found in the males of *hindei*.

*C. frater* is about the size of *C. limbatus* (Peters) from Mozambique, with which it shares the character of white wing membranes, but *limbatus* evidently (judging from descriptions) belongs to a different section of the genus (*Lophomops*), the males being said to have a "long crest of erect hairs behind the connecting membrane of the ears" (de Winton). The absence of white on the lower parts and the character of  $p^2$  would also exclude *limbatus* from further consideration in this connection.

56. **Chærephon russatus** sp. nov.

Text Fig. 25, p. 550.

Type, No. 48925, ♂ ad., skin and skull, Medje, Belgian Congo, Sept. 8, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 993.

Above uniform russet-brown, with a large median nearly hairless spot at shoulders; below cinnamon-brown, the extreme tips of the hairs on the median area faintly lighter in some specimens but as a rule not appreciably so; a band of cinnamon-brown bordering the underside of wing membrane between humerus and femur; wing membrane (in dry skins) dark brown proximally as far as the fourth digit, the outer portion slightly paler and semitranslucent; uropatagium dull brown, both above and below. Ears thickened on front border, blackish brown, united by a membrane at base, which projects as a rounded protuberance in front of the ears. Tragus minute, narrow, about 3.5 mm. high by about 1 mm. wide, blackish. Antitragus rather small, about 5 mm. wide at base and 3.5 in height, evenly rounded above. Tail about 34 mm. in length, the apical half free, the basal third below

furred. Pad at the base of the thumb large. (For illustration of wing see Part II, p. 550, by Lang and Chapin.)

Collectors' measurements of type: Total length, 102 mm.; head and body, 68; tail, 31; foot, 10; ear, 21. Additional measurements from the dry skin: Forearm, 45.7; third metacarpal, 45.4; tibia, 38; foot, 10.5; ear, length of outer border, 25.7; height from crown, 19.3.

Collectors' measurements, type and 23 adult topotypes (4 males, 20 females): Total length, 100 (93-105); head and body, 67.8 (62-73); tail, 33.1 (29-36); foot, 11.2 (10-13); ear, 20.2 (19-22). Forearm, from the skins (same specimens), 44.6 (42-46).

Skull rather deep and narrow; median and lambdoid crests weakly developed, especially the former; preorbital ridge conspicuous; premaxillæ fully ossified, enclosing a pair of small palatal foramina. Upper incisors small, slightly separated at base with their tips nearly or actually in contact (in different specimens); lower incisors  $\frac{2-2}{2-2}$ , small, all bifid, the inner more deeply so than the outer with the inner lobe the larger; outer incisors partly posterior to the middle pair. Upper canines with a broad, deep longitudinal groove and small cingulum without cusps; lower canines without distinctive features. First upper premolar minute, closely crowded between the adjoining teeth and wholly separating them; second upper premolar large, more than half the size of  $m^1$ ; first lower premolar a little smaller than the second.

Skull (type), total length, 18.7; condylobasal length, 16.6; zygomatic breadth, 11; mastoid breadth, 10.1; interorbital breadth, 4.1; maxillar breadth, 7.9; breadth of braincase, 9.3; upper toothrow (with canine), 6.4; length of mandible, 12.2; angle to condyle, 2.5; depth at coronoid, 3; lower toothrow, 7.

Skull, type and 22 topotypes, total length, 18.5 (17.8-19.4); zygomatic breadth, 11 (10.5-11.4).

Represented by 27 specimens (24 skins with skulls, 3 alcoholic), all taken at Medje, September 8, 1910.

The series is exceedingly uniform in both coloration and measurements. The pelage of the dorsal surface is without light tips to the hairs, and the pelage of the ventral surface is nearly so, a few of the specimens, however, having the extreme tips of the hairs pale buffy over the median area.

*Chærophon russatus* closely approaches *C. demonstrator* (Thomas) in size and proportions, but the latter is somewhat larger, especially in cranial measurements, the zygomatic breadth being about 2 mm. greater. The upper canine and second upper premolar are said to be in contact in *C. demonstrator*, with the minute first premolar in the outer angle between them, while in *russatus* the small premolar is in the middle of the toothrow, completely separating the canine from  $p^4$ . The description of the coloration of *demonstrator* also does not agree well with that of *russatus*, nor does the indicated structure of the ears. The fleshy protuberance in front of the ears seen in *russatus* is found also in other species, which in other respects are widely different. It is said not to be present in *demonstrator*. In an alcoholic male of *russatus* there is no indication of the pair of scent glands



at the base of the penis, mentioned as a distinctive feature of the unique type of *demonstrator*.

### 57. *Chærephon* sp. indet.

One specimen, semiadult male, skin and skull, Avakubi, Dec. 28, 1913.

Collectors' measurements: Total length, 109 mm.; head and body, 71; tail, 38; foot, 12; ear, 22. Forearm, from skin, 48; skull, total length, 20.4; zygomatic breadth, 10.5.

Color above russet; underparts ochraceous tawny. Ears and wing membranes wholly blackish brown; limb-bones blackish above, whitish below.

Evidently fully adult as regards coloration and other external features, except that the phalangeal epiphyses are still free, the outer milk incisors and the right milk  $p^2$  are still present, and the frontal bones are not united on the midline, but the rami are firmly joined. The cranial and external measurements are consequently somewhat below normal adult size.

This specimen is possibly referable to *Nyctinomus aloysii-sabaudia* Festa, from Torro, Ruwenzori, but this species is not identifiable from the description given, no mention whatever being made of the skull, and the coloration is given simply as clear chestnut ("castagno chiaro" = *russet* del Ridgway), the hairs lighter basally, with no indication that the underparts are lighter than the back, or ochraceous tawny, as in the present specimens. The measurements would apparently agree with an adult example of the present form. Geographical considerations, however, indicate that the two forms should not be closely related.

The nearest species to this specimen in the present Congo Collection is *Chærephon russatus*, from Medje, from which it differs in being much larger, and strikingly different in coloration.

### *Lophomops* subgen. nov.

Text Figs. 9-11.

Type *Chærephon* (*Lophomops*) *chapini* sp. nov.

Skull and dentition as in the smaller species of *Chærephon*, but outer lower incisors often deciduous, giving an incisive formula of  $\frac{1-1}{1-1}$  instead of  $\frac{1-1}{2-2}$ .

Ears united in front by a deep membrane, from the back of which arises a heavy crest of long straight hairs, occupying the whole posterior face of the membrane and rising above the tops of the ears as a broad frontal transverse crest, the hairs of which are dark brown for the basal half and lighter brown or (in one of the species, selected as the type) white for the apical half. It is apparently a sexual character, but only males have thus far been examined except in the rather aberrant *C. (L.) abæ*. For

decorative effect, especially when the crest hairs are particolored — rufous at base and pure white for the apical half, as in *C. (L.) chapini* — it vies with the spectacular head ornamentation occurring in many groups of birds.

The taxonomic value of *Lophomops* may be open to question. The peculiar character of the crest is not only its great size and striking effect, but the fact of its origin being from the whole posterior face of the deep membrane connecting the ears, instead of from the front of the head behind the ears. A number of species of both *Chærephon* and *Nyctinomus* have slightly lengthened tufts of glandular hairs behind the ears arising from the front part of the crown (not from the connecting membrane of the ears), consisting usually of lengthened crinkled hairs, a little longer and coarser than the adjoining fur, and usually of a darker color. These patches of specialized hairs frequently appear to be restricted to males, but in some species are present in both sexes, as is the case with the gular sac. They are, however, inconspicuous in comparison with the crests of the *Lophomops* group. Three species of this group are here described, of which *Chærephon (Lophomops) chapini* is here designated as the type.

*Dysopes limbatus* Peters (now regarded as a *Chærephon*) is described by de Winton<sup>1</sup> as having a "long crest of erect hairs behind the connecting membrane of the ears in the males," but he does not say that they arise from its posterior face. Peters does not describe nor does his figure represent any such crest as is seen in *Lophomops*. He simply says: "Die Haare auf dem Kopfe hinter der Vereinigung der Ohren sind länger und steifer als am übrigen Körper." The type locality of *Dysopes limbatus* is Mozambique Island, and it is possible that the specimens de Winton had in hand were not the true *limbatus* of Peters, and are perhaps referable to some form of *Lophomops*. *C. limbatus* (Peters) is probably a near relative of *C. hindei* (Thomas).

58. **Chærephon (Lophomops) chapini** sp. nov.

Text Fig. 9.

Type, No. 48841, ♂ ad. (skin and skull; topotype, No. 49209, ♂ ad., alcoholic), Faradje, northeastern Belgian Congo, Nov. 11, 1912 (topotype, Jan. 12, 1913); Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1971.

Head in males conspicuously crested, the crest arising from the posterior face of the deep membrane connecting the ears; breadth of the crest at base, 8.5 mm.; length of crest, 13 mm. in type, 14 in topotype; basal half reddish chestnut, apical

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<sup>1</sup> Ann. and Mag. Nat. Hist. (7), VII, p. 39, Jan., 1901.

half white; breadth of crest across the top when expanded (Figs. 9, A, B, C) about 20 mm. A broad tuft of soft whitish hairs covers the front of the crown behind the crest. Body above pale cinnamon-brown, the fur whitish basally; below grayish brown, the middle of the belly whitish; a narrow band of white at proximal edge of wing membranes, between humerus and femur, continuous with a similar band at base of uropatagium; wing membranes white, becoming yellowish proximally; the

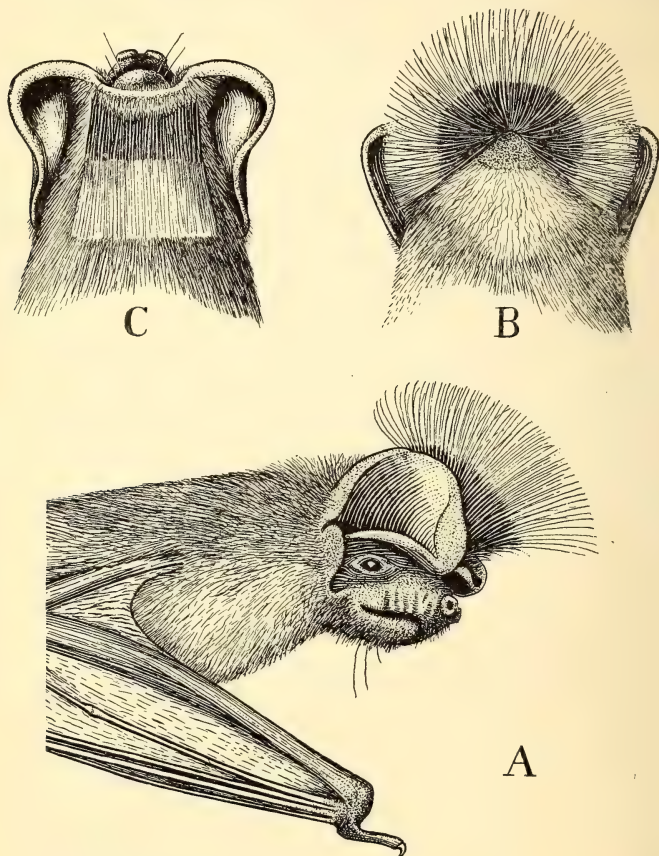


Fig. 9. *Chærephon (Lophomops) chapini*. Adult male (type, No. 48841). A, side view of head, crest erect; B, view of crown, crest erect; C, same view, crest laid back. All  $\frac{3}{4}$ .

portion adjoining the body, between humerus and femur, thickly punctated with minute blackish specks; interfemoral membrane dark brown above and below; limb bones dark brown above, in strong contrast with the light colored membranes, below light brown like the membranes; tail blackish. No gular pouch.

Collectors' measurements of type: Total length, 84 mm.; head and body, 56; tail, 28; foot, 7; ear, 14. Additional measurements from the dry skin: Forearm, 34; third metacarpal, 37; ear from crown, 8.5. Tragus minute, quadrate, about 1.5 square; antitragus small, about 5 broad at base and 3 high.



Measurements of the alcoholic topotype: Total length, 80; head and body, 48; tail, 32; forearm, 37; third metacarpal, 39; third digit, 72; tibia, 11.8; foot, 7.7; ear from crown, 9.5, from notch behind antitragus, 12.8; expanse of both ears from tip to tip, 27.

Skull (measurements of topotype in parenthesis), total length, 15.5 (16); zygomatic breadth,—(9.5); interorbital breadth, 3.5 (3.5); mastoid breadth, — (9); breadth of braincase, 7.6 (7.7); maxillar breadth, 6.5 (6.8); upper tooththrow (c-m<sup>3</sup>), 5.4 (5.8); length of mandible, 10 (10.4); angle to condyle, 2.6 (2.6); depth at coronoid, 2.6 (2.6); lower tooththrow, 5.9 (6.4). Upper incisors parallel, slightly separated, a wide space between them and the canines; lower incisors bifid, 1-1 (in both type and topotype), completely filling the space between the canines. First upper premolar minute, in the tooththrow, separating the canine and p<sup>4</sup>; first lower premolar smaller and with much lower crown than the second. Premaxillæ fully ossified; palatal foramina coalesced, forming a small U-shaped vacuity; presphenoid pits deep, slightly longer than wide; preorbital (lacrymal) processes strongly developed; median crest slightly indicated, lambdoid crest moderately strong. In general features the skull is as in other small species of *Chærephon*.

*Chærephon (Lophomops) chapini* is represented by only the type and a topotype, both old males from Faradje. It evidently has no close relationship to any known species. Its conspicuously heavy and long particolored crest distinguishes it at once from the other known species of the *Lophomops* group.

59. **Chærephon (Lophomops) cristatus** sp. nov.

Text Fig. 10, A, B.

Type, No. 48844, ♂ ad. (skin and skull), Boma, near mouth of Congo River, Belgian Congo, Jan. 26, 1915; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2628.

Head crested, the crest arising from the posterior face of the deep membrane uniting the ears. Crest (Fig. 10, A, B) shorter than in *C. chapini*, the hairs reddish apically, the basal half darker, the transition between the two tones abrupt. Whole top of the head behind the crest naked, but covered by the crest hairs when the crest is laid back. Body above uniform russet, the basal portion of the fur but little lighter than the tips; underparts dark cinnamon-drab, the middle area with light tips to the hairs, in contrast with the sides; an indistinct median whitish band from the pectoral region posteriorly; a narrow band of soft white fur along the inner edge of the wing membrane from the humerus to the femur and continued across the lower abdomen at base of the uropatagium. Face and gular region naked and blackish, bordered below by a naked flesh-colored band. Wing membranes as in *C. chapini* but whiter, the upper surface in strong contrast with the blackish limb bones; the dorsal side of the membrane along the sides of the body, between humerus and femur, thickly set with blackish dots, most of which support a minute bristly hair, visible only under a strong lens, and more obvious than in the specimens of *C. chapini*. Interfemoral membrane dark slaty brown above, somewhat lighter below. No gular pouch. Upper lips corrugated.

Collectors' measurements of type: Total length, 87 mm.; head and body, 56; tail, 31; foot, 9; ear, 13. Additional measurements from the dry skin: Forearm, 36; third metacarpal, 35; tibia, 10; foot, 8.7; thumb, 6; ear from crown, 9.2; length of crest hairs, 9.5.

Three male topotypes (Nos. 49216, 49237, 49359) in alcohol: Total length, 84, 83, 80; head and body, 51.5, 53, 48; tail, 32, 31, 32; forearm, 36, 36.2, 36.4; third

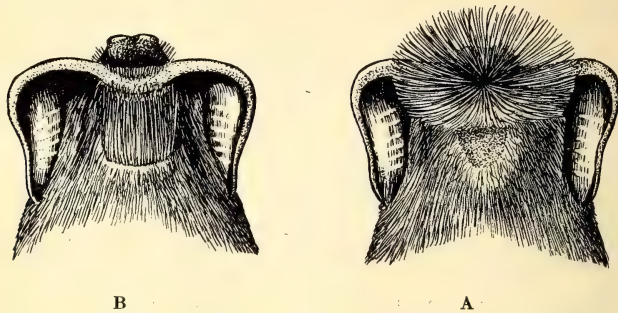


Fig. 10. *Chærephon (Lophomops) cristatus*. Adult male (No. 49259). A, crest erect; B, crest laid back. All  $\frac{3}{2}$ .

metacarpal, 36, 34, 35; third digit, 66, 65, 66.5; ear from crown, 9, 8, 8; height from notch behind antitragus, 14, 13, 13.5; extent of both ears from tip to tip, 28, 29, 29; tibia, 11, 11.5, 11; foot, 7, 6.7, 8; length of crest, 9, 8, 9; width at base, about 6.5.

Skull, type (topotype No. 49216 in parenthesis), total length, 16.3 (16); zygomatic breadth, 9.7 (9.8); mastoid breadth, 9 (9.2); interorbital breadth, 3.6 (3.8); maxillar breadth, 7 (7.2); breadth of braincase, 8 (8); depth of skull at pterygoids, 6 (6.3); upper tooththrow (c-m<sup>3</sup>), 5.5 (5.7); length of mandible, 10 (10.3); angle to condyle, 3 (3.2); depth at coronoid, 2.8 (2.8); lower tooththrow, 6 (6.2).

*Chærephon (Lophomops) cristatus* is represented by the type and three topotypes, all collected at Boma, January 25-29 and June 15, 1915. The type lacks the middle pair and one of the outer lower incisors, which had been shed in life; one of the topotypes has only the middle pair, which occupies the whole space between the canines; the other has the middle pair and a minute outer incisor on the left side, showing that in the *Lophomops* group the lower incisors are doubtless normally 2-2. This species is slightly larger than *C. chapini* and differs from it strikingly in coloration, aside from the difference in the color and length of the crest.

#### 60. *Chærephon (Lophomops) abæ* sp. nov.

Text Fig. 11.

Type, No. 48887, ♀ ad., skin and skull, Aba, northeastern Belgian Congo, Dec. 17, 1911; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1823.

Above hair-brown, with a slight grayish sheen; below a narrow median whitish band from breast to anal region, and a narrow white border at base of wing membranes from humerus to femur; rest of underparts like the back but without the grayish sheen; membranes lightish brown above and below. Male with a conspicuous cinnamon-brown crest, lacking in the female.

Ears thin, dark brown, rising separately from the crown, the intervening space being occupied by an erectile membrane, convex above and about 5 mm. high, from the back of which arises, in the male, a thick mass of brown hairs, about 7 mm. in length and reaching 3 mm. above the crest of the convex membrane (Fig. 11); the basal three fifths of the hairs a darker shade of cinnamon-brown than the apical two fifths; in females (at least in dry skins) the membrane is directed backward,

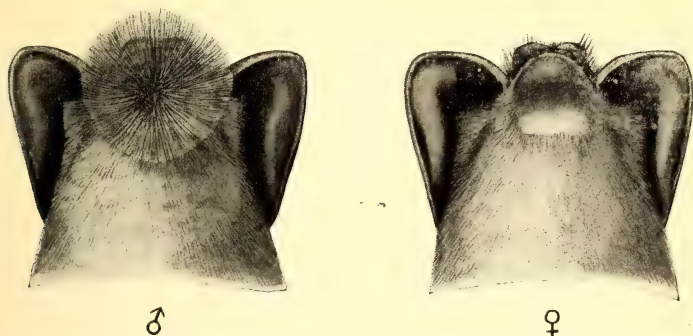


Fig. 11. *Chærophon (Lophomops) abæ*. ♂, crown view of head, male; ♀, crown of head, female.  $\frac{3}{2}$ .

covering the crown, which is naked or covered only with a slight pubescence on the upper border and in front; crown beneath bare (as seen by softening and raising the disk or lappet).<sup>1</sup> The size of the lappet varies in different specimens, being not fully developed in the younger examples.

Skull with the braincase broad and flat, rising only slightly above the rostral portion of the skull. Sagittal crest weakly developed or barely indicated; lambdoid crest moderate; preorbital processes strongly developed; premaxillæ well ossified in old skulls, but in young adults there is often a small U-shaped vacuity behind the incisors.

Collectors' measurements of type: Total length, 103 mm.; head and body, 69; tail, 34; foot, 10; ear, 17. Forearm (from skin), 43.

Collectors' measurements of type and 22 topotypes: Total length, 102 (97-107); head and body, 67.3 (62-73); tail, 33 (29-35); foot, 10.6 (10-11); ear, 18 (17-19).

Forearm, from skin (same specimens), 42 (40-44).

Skull (type), total length, 18.5; condylobasal length, 17.3; zygomatic breadth, 11.2; mastoid breadth, 10.7; interorbital breadth, 3.8; maxillar breadth, 8.1;

<sup>1</sup> Unfortunately there are no alcoholic specimens of this species available for examination, the supply of alcohol having given out on this part of the journey, and the collectors were for some weeks unable to renew it. A considerable number of the skins, however, have been softened for examination, with results as here detailed. The membranous lappet appears to arise just behind the inner base of the ears and to be not actually joined to them.



breadth at base of canines, 5.4; breadth of braincase, 9; depth of braincase at pterygoids, 6.1; length of upper tooththrow (c-m<sup>3</sup>), 6.7; length of mandible, 12.3; angle to condyle, 3.5; depth at coronoid, 3.4; length of lower tooththrow, 7.6.

Skull, average of 10 specimens, total length, 18 (17.5-18.8); zygomatic breadth, 11.2 (11-11.4); breadth of braincase, 9.2 (8.7-9.8).

Represented by a series of 25 specimens, all collected the same day at Aba. Four additional specimens from Faradje, collected Feb. 25, 1911, are so similar in every respect to the Aba series that they seem preferably referable to the same species. The external measurements are slightly less, but the skulls indicate greater maturity and are as large as those of the Aba series. The coloration, however, is less dark and more buffy. They probably represent a slightly differential local race of the Aba form.

*Chærephon* (*Lophomops*) *abæ* resembles, in size and coloration, *C. major* (Trouessart), and *C. emini* (de Winton) in size, but not in color. As neither of these species, so far as known, is crested in the males, nor possess the conspicuous and (probably) erectile lappet in the females, and ununited ears, they require no special consideration in the present connection. The uniform brown coloration of the membranes, and usually the size, will readily separate *abæ* from the other known forms of the *Lophomops* group.

#### 61. *Mops*<sup>1</sup> *midas* (Sundevall).

*Nyctinomus midas* SUNDEVALL, Vet. Akad. Handl. Stockholm, 1841 (1842), p. 207, pl. ii, fig. 7, skull and head. White Nile, Africa.

Six specimens (alcoholic), 3 males and 3 females, all adult, Faradje, March 7-9, 1912.

Measurements of an adult female (No. 49272): Total length, 137 mm.; head and body, 95.5; tail, 41.5; forearm, 60.4; third metacarpal, 58.5; tibia, 19; foot, 10.5; ear from crown, 15.6; height from notch at posterior base of antitragus, 24; breadth of both ears from outer border of each, 44.5.

Forearm, average of 6 adults, 60.6 (59.2-64).

Skull massive, narrow and deep, strongly constricted postorbitally, and with a low median crest, highest just in front of braincase. First upper premolar minute, in the tooththrow, separating the canine from p<sup>4</sup>. Lower premolars subequal, the first slightly lower than the second.

Measurements of skull (♀ ad., No. 49272): Total length, 27.4; zygo-

<sup>1</sup> *Mops* Lesson, 1847, has been revived by Thomas as an available name for a group of Old World free-tailed bats, previously of late referred in part to *Nyctinomus* and in part to *Chærephon*, in a paper bearing the cryptic title (considering the matter it covers), 'On a remarkable new Free-tailed Bat from Southern Bombay.' See Journ. Bombay Soc. Nat. Hist., XXII, pp. 87-91, April, 1913, especially the 'postscript.'

matic breadth, 16.4; mastoid breadth, 14.1; breadth of braincase, 12; interorbital breadth, 4.3; breadth at canines, 7.8; upper toothrow (c to m<sup>3</sup>), 10.1; depth of skull at pterygoids, 9.6; length of mandible, 18; angle to condyle, 5.8; depth at coronoid, 4.8; lower toothrow (c-m<sup>3</sup>), 11.5. Average of 6 adult skulls, total length, 27.2 (27-27.8); zygomatic breadth, 16.5 (16.1-16.8).

This species is readily distinguishable by its large size and large and thin ears. The pelage is short and thin, the whitish basal portion showing through the pale brown tips of the hairs.

62. **Mops congicus** sp. nov.

Plate LV.

Type, No. 48893, ♀ ad. (skin and skull), Medje, Belgian Congo, Sept. 8, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 966.

Above uniform deep chestnut-brown, the extreme base of hairs rufous; sides of back and lower back naked; below snuff-brown, passing into bistre laterally, the extreme tips of the hairs on the middle area buffy; a naked band at base of uropatagium, continuous with the wholly naked hind limbs; wing membranes naked, blackish brown above, a little lighter brown below; interfemoral membrane naked, dull brown above and below. Ears joined by a low membrane, which extends forward as a protuberance in front of the ears; ears thick and leathery, black, with a strong frontal keel; tragus minute, difficult to distinguish in dry skins; antitragus small, low, evenly rounded above, about 5 by 3 mm. Face and chin naked, dark brown; nostrils prominently projecting; upper lip heavily corrugated; thumb with a conspicuous basal pad. A very small patch of fur near outer base of humerus, and a dense patch on inner upper border of ear; outer base heavily furred.

Collectors' measurements of type: Total length, 140 mm.; head and body, 91; tail, 49; foot, 17; ear, 22. Type and 12 adult topotypes: Total length, 138 (131-145); head and body, 93.4 (86-100); tail, 45.3 (41-49); foot, 15.8 (15-17); ear, 22 (20-24). Additional measurements from skins: Type, forearm, 55; third metacarpal, 54; thumb (with claw), 9.3; foot, 15.8; length of ear on outer border, 19; breadth of ear near upper border, 9.5. Forearm, type and 14 topotypes, 55.8 (54.7-57.4).

Skull narrow and deep, heavily ossified; a low continuous median crest from front of interorbital constriction, joining the rather heavy lambdoid; preorbital process weak; braincase with a strong transverse preoccipital depression; basisphenoid pits very deep and large, circular in outline. Upper incisors slightly separated and parallel; lower incisors, middle pair bifid, the outer slender, posterior to the middle pair; canines not specially modified; first upper premolar minute, in the toothrow, separating the canine from p<sup>4</sup>; first lower premolar about equal in size to the second.

Skull of type: Total length, 25; condylobasal length, 22.4; zygomatic breadth, 15; mastoid breadth, 13.2; interorbital breadth, 4.7; maxillary breadth, 10.3; breadth

at canines, 8.7; breadth of braincase, 11.7; depth of braincase at condyles, 9.5, at bullæ, 10.7; upper toothrow (with canine), 8.9; length of mandible, 19.4; angle to condyle, 5.6; depth at coronoid, 4.6.

Skull, type and 11 topotypes (1 male, 10 females), total length, 25 (24.4–25.6); zygomatic breadth, 15 (14.5–15.6).

Represented by 15 specimens (of which 3 are alcoholic), all taken at Medje, September 8, 1910.

*Chærephon congicus* is easily distinguished by its size, and dark coloration. The length of the forearm averages 56 mm. in a series of 12 adults, the skull 25, zygomatic breadth 15. It greatly exceeds the size of *C. angolensis*, from which it also differs in other important characters. The forearm in *angolensis* is given by Peters as 48 mm., and by Dobson as 47 mm., while the average in *congicus* is 55.8. It differs from *C. midas* in being smaller (forearm 55.8, in *midas* 60.4), with much smaller ears and much darker coloration.

### 63. *Mops niangaræ* sp. nov.

Type (and only specimen), No. 48901, ♂ ad. (skin and skull), Niangara, north-eastern Belgian Congo, Dec. 12, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1313.

Similar to *M. congicus* but smaller and much paler.

Upperparts uniform cinnamon-rufous, extreme base of hairs much lighter; underparts tawny-brown, lighter and more yellowish on the pectoral area; ears, membranes and the broad naked space along sides of back and posterior margin of body dark brown; ears not joined at base, thick, and otherwise as in *M. congicus*. A large crown-patch of lengthened hairs, similar in color and texture to the surrounding pelage, but much longer, forms a broad, low crest covering the interaural portion of the head.

Collectors' measurements: Total length, 125 mm.; head and body, 91; tail, 34; foot, 13; ear, 22. Forearm (from skin), 52; third metacarpal, 52; foot, 13; ear from crown, 8.6; from notch at antitragus, 21; transverse breadth, 13.2; tragus very small, breadth at base and height about equal.

Skull, total length, 23.2; condylobasal length, 21.6; zygomatic breadth, 14.4; breadth of braincase, 11.1; interorbital breadth, 4.6; maxillar breadth, 9.8; breadth at base of canines, 7.1; upper toothrow (with canine), 8.2; length of mandible, 16; depth at condyle, 5.4; at coronoid, 4.5; lower toothrow, 9.4.

*Mops niangaræ* is structurally closely similar to *M. congicus*, but is smaller and much paler, and the ears are not joined by a membrane. The forearm is 4 mm. shorter and the cranial measurements are correspondingly less.

This is the only species of molossid bat in the present collection, numbering 19 species, in which the ears are not joined across the forehead by a strongly developed band, if we regard the high convex lappet between the ears, but not distinctly joined to them, in *Chærephon* (*Lophomops*) *aba* as



morphologically a connecting ear-band. In the present species (represented by the single type specimen) there is not even a vestigial band, but the position it should occupy if present is outlined by a line of slightly lengthened dark brown hairs, giving the visual effect of a vestigial band till it is carefully examined and found not to be a slight ridge of membrane.

64. **Mops trevori**<sup>1</sup> sp. nov.

Plate XLVIII, Fig. 2.

Type, No. 49250, ♀ ad. in alcohol, Faradje, Sept. 29, 1912; H. Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1954.

Pelage short, soft and fine, with the grayish sheen in certain lights seen in many other molossid bats.

Upperparts cinnamon brown, with the usual naked transverse zone across front of shoulders; underparts pale brown, darker on the sides and lighter medially, with the hairs of the pectoral region conspicuously tipped with grayish white; caudal end of body not denuded, but with the projecting bristly hairs seen in allied forms. Membranes and wing bones above blackish and naked, except for a small patch of short brown fur near the center of the propatagium; below much lighter and the wing bones whitish; naked portion of face and ears, and the naked hind limbs and tail blackish; interfemoral membrane above blackish, below much paler, as is also the ventral surface of the hind limbs. A low crest (the hairs about 5.5 mm. in length) arises from the back of the membrane connecting the ears and extends back over the front half of the interaural area and the basal half of the backs of the ears. The crest area is of the same color as the surrounding pelage.

Total length, 121.5 mm.; head and body, 82.3; tail, 39.2 (free portion 24); forearm, 53; third metacarpal, 53.5; thumb to base of pad, 8.4; tibia, 20; foot, 13.6; ear from notch, 20; breadth (near front border), 12; tragus minute, quadrate,  $2 \times 1.5$ ; antitragus convex, broad at base and low,  $6.5 \times 4$ .

Skull, total length, 24.2; condylobasal length, 22; zygomatic breadth, 14.6; interorbital breadth, 5; mastoid breadth, 13.8; maxillar breadth, 10.4; breadth at base of canines, 7; upper tooththrow (c-m<sup>3</sup>), 8.6; length of mandible, 15.8; angle to condyle, 5.2; depth at coronoid, 4.5; lower tooththrow, 9.7.

Represented only by the type.

- *Mops trevori* is of nearly the same size as *M. congicus*, but it is slightly smaller in all measurements, except that the ears are larger. The coloration is radically different, the upperparts in *congicus* being deep chestnut, and dull cinnamon brown in *trevori*, with still greater difference in the color of the underparts. It differs from *M. midas* in much smaller size, while the color of both upperparts and the ventral surface in the two species is as different as between *trevori* and *congicus*. In cranial characters *trevori* is too different from either *congicus* or *midas* to render comparison necessary.

<sup>1</sup> Named for John B. Trevor, a Trustee of the American Museum of Natural History and Chairman of the Committee on African Exploration, whose enthusiasm and generosity in support of the Congo Expedition contributed greatly to its success.

**Allomops** subgen. nov.

Text Figs. 12-15.

Type, *Chærephon* (*Allomops*) *osborni* sp. nov.

Supraoccipital border of skull enormously developed in old males, the lambdoid crest high and broad, expanded upward and backward into an oblique overhang, equal in height to about one half the interorbital breadth of the skull, or considerably exceeding the width of the foramen magnum, the upper border nearly straight, equal in length to about one half the width of the braincase, with an extension

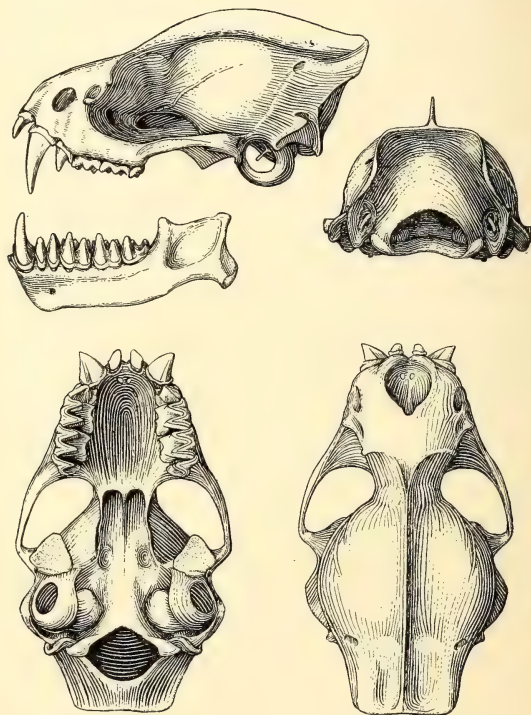


Fig. 12. *Mops* (*Allomops*) *osborni*. Skull of type, adult male, No. 49230.  $\frac{2}{1}$ .

downward from the lateral upper corner on either side to the mastoid process; less developed but strongly indicated in females and young males; sagittal crest weakly developed in the smaller species of the group, very heavily so in the larger forms.

General form of the skull as in *Nyctinomus*, the braincase broad and flattened, preorbital furrow or depression conspicuous, but preorbital processes absent; premaxillæ usually fully ossified on front border, but sometimes emarginate.

Dental formula:  $i \frac{1-1}{2-2}$ ,  $c \frac{1-1}{1-1}$ ,  $p \frac{2-2}{2-2}$  (or  $\frac{1-1}{2-2}$ ),  $p^2$  being deciduous or wholly absent in some species),  $m \frac{3-3}{3-3} = 30$  (or 28). Upper incisors small, about one third the length of the canines, parallel, widely separated from each other and the canines;

lower incisors very small, bilobed, the outer smaller than the middle ones, postero-external to them in position, often one or both outer lower incisors deciduous. Upper canines very long, slender and sharp-pointed, with a broad, shallow longitudinal groove on the front face, and a narrow postero-internal cingulum; lower canines correspondingly slender, with a broad postero-internal cingulum. First upper premolar ( $p^2$ ) minute, in the toothrow (usually) or external to the base of the canine, sometimes deciduous;  $p^4$  about half the size of  $m^1$ , larger than  $m^3$ . First lower premolar ( $p_2$ ) larger than  $p_4$  in males, smaller than  $p_4$  in females, the sexual difference in the size of  $p_2$  well marked in all the (four) known species. Upper molars with  $m^3$  small, about one third the size of  $m^2$ . Molar-premolar series in both jaws heavy, low and broad, with very broad mandibular rami.

Males larger than the females, the sexual difference in size especially evident

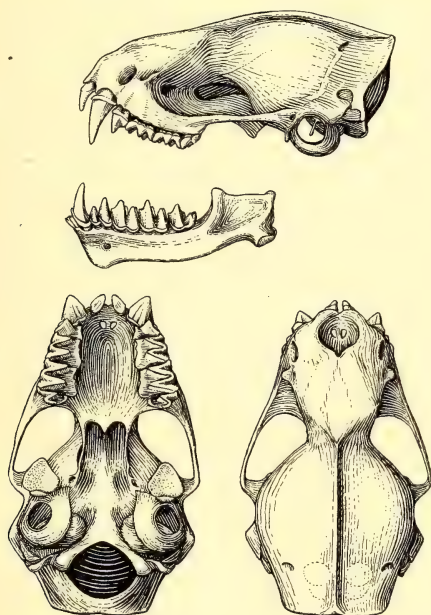


Fig. 13. *Mops (Allomops) osborni*. Skull of adult female, No. 49244.  $\frac{2}{1}$ .

in the skulls, where it is emphasized by the much larger size of  $p_2$  in the males than in the females relatively to the size of  $p_4$ . Ears of medium size, thick and heavy, united at the base by a broad membrane, which extends forward as a conspicuous protuberance in front of the ears. Tail relatively short, about two fifths of the length of head and body, rather more than the apical half free. Sides of back naked, the naked space continuous with the naked hind limbs and naked hinder portion of the body, which is bare of fur on both surfaces posterior to a line joining the hips. From the region of the hips arises a fringe of scattered blackish bristles, directed backward and reaching to or beyond the middle of the uropatagium, the number of these bristly hairs varying, even in different individuals of the same species, from a few to a fairly conspicuous fringe. Pelage of the upperparts exceptionally short, soft and velvety; on the underparts longer and more dense. Color pattern distinctive,—very dark



above and along the sides of the body below, without white at the base of the patagium. Wing membranes blackish, thick and leathery.

The present group, whether considered as of generic or as only of subgeneric value, is a natural group, much more sharply defined from all others than is *Chærephon* from *Nyctinomus*, although these two groups have been long currently given recognition as genera. In the present connection it is given subgeneric rank. The four known species are here described as new, although one of them may be the same as *Nyctinomus thersites* of Thomas, which apparently belongs to the *Allomops* group. They are small to medium sized species, one of them, *Allomops nanulus*, being the smallest known African molossid.

In working out this group, in connection with other African molossid material, I have been impressed with the small value of the character most commonly considered as an important index to the relation of species referred to *Nyctinomus* and *Chærephon*, namely, the emargination or non-emargination of the front border of the premaxillæ. In one instance in the study of a series of 23 specimens collected the same day at the same locality, and evidently beyond question conspecific, I took up the skulls first, with skulls of other species, to determine their generic affinities. Later on collating the skulls (marked only with their catalogue numbers) with the skins to which they belonged, I found I had referred part to *Nyctinomus* and part to *Chærephon*! Further study of the same series showed that in this case at least emargination and non-emargination of the front border of the premaxillæ was largely dependent on the age of the specimen, the vacuity behind the incisors becoming gradually closed by ossification with the increased age of the specimen.

In one of the species here referred to *Allomops*, represented by six adult specimens, two, on the basis of the condition of the premaxillæ, are typically *Nyctinomus* and the other four typically *Chærephon*. They were otherwise indistinguishable, either on the basis of external and cranial characters or by the age of the specimen. In another species here referred to *Allomops*, represented by seven specimens, all of the skulls had the front palatal border emarginate, but as all of the other characters, both external and cranial, were typical of the *Allomops* group, it seemed proper to give preference to the combined weight of the *Allomops* characters, despite the *Nyctinomus*-like condition of the premaxillæ.<sup>1</sup>

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<sup>1</sup> After writing the above I first became aware of Oldfield Thomas's paper, entitled 'On a remarkable new Free-tailed Bat from Southern Bombay' (Journ. Bombay Soc. Nat. Hist., XXII, pp. 87-91, April, 1912), in which he states that he had reached the same conclusion regarding the emargination or non-emargination of the front border of the premaxillæ in the Old World molossid bats. He says: "I may note also that all sorts of intergradations are found in the premaxillæ and that it is often almost impossible to decide whether a given specimen should be referred to one genus or the other [*Nyctinomus* or *Chærephon*] by this character of the premaxillæ."

65. **Mops (Allomops) osborni**<sup>1</sup> sp. nov.

Text Fig. 12-14, and 26.

Type, No. 49230, ♂ ad. (in alcohol), Kinshasa (near Leopoldville), Belgian Congo, Dec. 22, 1914; cotype, No. 94244, ♀ ad. (alcoholic), same locality and date. Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. of type, 2570.

Upperparts dark hair-brown with a grayish sheen, the hairs whitish at extreme base; underparts, sides paler brown than back, the hairs grayish-tipped, the central area from chest posteriorly broadly white, throat and an indistinct pectoral band grayish brown; wing membranes and limb bones above dark brown, below lighter, becoming whitish toward the body, including the propatagium and a narrow posterior edging; uropatagium dark brown above, whitish below; ears united by a deep band, the back of the membrane (in both sexes) covered with lengthened hair-brown hairs which barely reach its upper border (Fig. 14). Tragus minute; antitragus small (about  $4 \times 4$  mm.), evenly rounded above. Sides of back, lower back and hind limbs above naked and dark brown; under side of limbs and anal region naked and yellowish white. Face dark brown; upper lip heavily corrugated. No gular pouch in either sex. Feet heavily clothed with spoon hairs (see Fig. 26, p. 556).

Total length, male type, 111.3, female cotype, 106.6; head and body, 73.5, 70, tail, 37.8, 36.6; forearm, 49, 47; third metacarpal, 47.2, 46.5; tibia, 17.5, 16.5; foot 10.5, 10.2; ear from crown, 8.5, 9; length from notch at posterior base of antitragus, 14.7, 12.5; expanse (tip to tip), 33.8, 32.

Skull in the old-adult male type with a highly developed sagittal crest, as in *Molossus*, but differing from the latter in having also the lambdoid crest enormously developed, as in some other species of the *Mops* group. In the male type the sagittal crest has a height of 1.8 mm. and extends from the interorbital region to the lambdoid; in the female cotype neither the sagittal nor the lambdoid is more developed than in some species of *Nyctinomus* (e. g., *N. ochraceus* and *N. leonis*). Rostral and interorbital regions broad (as in other species of the group), the braincase wide and rounded; premaxillæ fully ossified; palate deeply concave; basisphenoid pits small and shallow;  $p^2$  vestigial, on the outer edge of the toothrow and difficult to see without the aid of a strong lens. The type has only one upper incisor, the right having been lost in life. (Figs. 12 and 13).

Measurements of type (male) and cotype (female) skulls: Total length, ♂ 22.9,

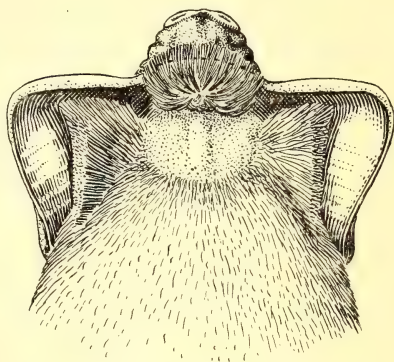


Fig. 14. *Mops (Allomops) osborni*. Crown of male type, to show the small crest on back of frontal membrane.  $\frac{3}{2}$ .

<sup>1</sup> Named in honor of Professor Henry Fairfield Osborn, President of the American Museum of Natural History, to whose unflagging interest and wise foresight in support of the Lang-Chapin Congo Expedition is largely due its monumental success.

♀ 20.7; condylobasal length, ♂ 19.6, ♀ 18.6; zygomatic breadth, ♂ 13.4, ♀ 12.6; mastoid breadth, ♂ 12.2, ♀ 11.8; breadth of braincase, ♂ 10.4, ♀ 9.9; interorbital breadth, ♂ 4.4, ♀ 4.5; breadth at base of canines, ♂ 6, ♀ 5.7; maxillar breadth (between outer borders of  $m^3$ ), ♂ 9, ♀ 9.2; depth of braincase medially (without the crest), ♂ 7, ♀ 6.8; upper toothrow (including canine), ♂ 7.7, ♀ 7.2; length of mandible, ♂ 15, ♀ 13.3; angle to condyle, ♂ 5.2, ♀ 4; depth at coronoid, ♂ 4.2, ♀ 3.4; lower toothrow (including canine), ♂ 8.5, ♀ 8.1. Height of sagittal crest in male, 1.8, in female, 0.5.

Represented by 2 alcoholic specimens, type (♂) and cotype (♀), collected at Kinshasa, 6 miles from Leopoldville, lower Congo, December 22, 1914.

The only species with which the present form needs comparison is *Mops (Allomops) faradjius*, which differs from it in smaller size, less highly developed sagittal crest, less concave palate, and in certain other features indicated under *M. (Allomops) occipitalis*.

# 66. *Mops (Allomops) occipitalis* sp. nov.

Text Fig. 15.

*?Nyctinomus thersites* THOMAS, Ann. and Mag. Nat. Hist. (7), XII, p. 364, Dec. 1903. Efulen, Cameroons.

Type, No. 48851, ad. ♂, skin and skull, Avakubi, Belgian Congo, Feb. 13, 1914; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 2487.

Pelage short, soft and velvety, about 1.5 mm. in length on the back to about 2.5 on the sides of the neck, throat, and sides of body below. External base of ears and whole space between them thickly covered with slightly lengthened glandular black hairs, which also cover the back of the low connecting membrane, but do not rise much above it.

Fur of upperparts dark chocolate-brown; the sides of the back, the lower back from a line joining the hips posteriorly, and the hind limbs naked and blackish, the central furred portion of the back, from considerably in front of the shoulders to hips, of about the same width as the naked area each side. A scanty fringe of long bristly hairs (blackish or mixed with a few whitish ones) from the hips, directed backward, the longest reaching to or beyond the middle of the uropatagium (scanty or nearly wanting in some specimens). Underparts blackish laterally, the median area buffy brown; a ventral area (corresponding ventrally with that of the lower back) and limbs naked, pale rusty brown (the denuded space much reduced in some specimens). Ears near together, blackish brown, united by a low membrane which extends forward as a swollen obtuse projection reaching nearly half-way to the nose; front and upper border of ears thickened, forming a sharp angle at the anterior inner border; tragus merely a minute dusky point, about 2 mm. in height; antitragus brownish, small, about  $4 \times 4$  mm., bluntly convex above. Face naked, blackish; nostrils prominent, upper lip weakly corrugated; chin naked, brownish. Wings from middle of tibia. Forearm and membranes naked. Wing membranes above, including antebrachium, blackish brown, lighter, grayish brown apically; below simi-



lar, the humerus and forearm whitish, in strong contrast with the membrane. Uropatagium dark brown and naked on both surfaces.

Collectors' measurements of type: Total length, 98; head and body, 68; tail, 30; foot, 11; ear, 18. Additional measurements from the skin: Forearm, 38; tibia, 15.5; foot, 10; ear from crown, 9; from notch behind antitragus, 16.

Collectors' measurements of 4 specimens (2 males, 2 females) from Medje (near type locality): Total length, 99.4 (98-101); head and body, 70 (68-73); tail, 29.2 (28-30); foot, 9.6 (8-11); ear, 18 (all 18). Forearm (from the skins), 38 (36-39).

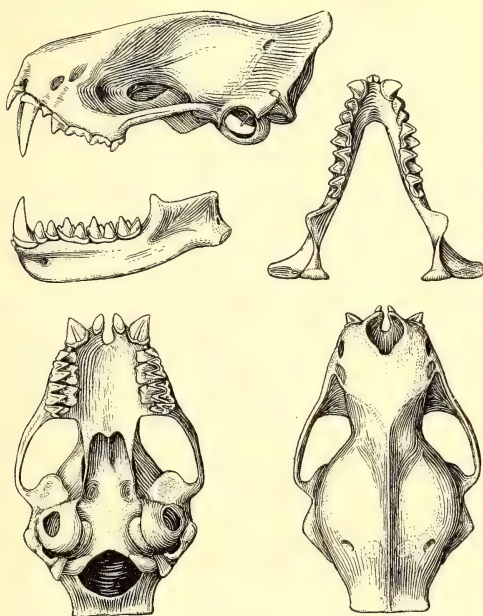


Fig. 15. *Mops (Allomops) occipitalis*. Skull of adult male type (No. 48851).  $\frac{2}{1}$ .

Measurements of the type skull: Total length, 20.4; condylobasal length, 18; zygomatic breadth, 12.7; mastoid breadth, 11.5; breadth of braincase, 9.5; inter-orbital breadth, 4.1; maxillar breadth, 8.2; breadth at canines, 5.8; depth (including pterygoids), 7.8; length of upper tooththrow (c-m<sup>3</sup>), 6.9; length of mandible, 13.4; angle to condyle, 4.5; depth at coronoid, 4; length of lower tooththrow, 7.4 (Fig. 15).

Four skulls from Medje: Total length, 2 young adult males, each 91.8; 2 young adult females, 18.3, 18.8; zygomatic breadth (2 males, 1 female), all 12.5.

In the adult males the skull has the occipital region enormously developed, the lambdoid crest being high and broad with a marked backward overhang. In females and young males (subadult) it is much less developed. The mandible is noticeably massive in even young specimens.

Represented by the type, from Avakubi, and 6 specimens from Medje, of which 2 are about half grown and the others young adults, collected Sept. 15-16, 1910.

Judging from the description, *Nyctinomus thersites* Thomas greatly resembles the present species but whether they are identical cannot be satisfactorily determined without direct comparison of the types. The description of *thersites* makes no direct mention of the coloration of the underparts, which in *occipitalis* are very unlike the upperparts, the coloration of *thersites* being described as "Colour brownish chestnut, glandular hairs back of ears black." Other features mentioned point strongly to a form greatly resembling *occipitalis*. In *thersites* the premaxillæ are thus described: "Premaxillæ separated, but opening between them small," for which reason the species has been regarded as a *Nyctinomus*. In six skulls of *occipitalis* the premaxillæ are fully ossified in four of them and in the other two (one of them the type and the most mature specimen) there is a slight opening behind and between the incisors. In a skull of *A. faradjius* (the only one available for examination) the premaxillæ are fully ossified. In five adult skulls of the much smaller *A. nanulus* there is a very small opening at the inner base of the incisors in all, but in all other characters, external and cranial, including color pattern and femoral bristles, *nanulus* is obviously only the little brother of the three larger forms here referred to *Allomops*.

67. **Mops (Allomops) faradjius** sp. nov.

Type, No. 49222, ♂ ad. (in alcohol), Faradje, northeastern Belgian Congo, Nov. 1, 1913; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 3015.

Similar to *A. osborni* in general size and in coloration, but with a shorter forearm (44 instead of 49 mm.), a vestigial  $p^2$  on the right side only, in the tooththrow (visible only by aid of a strong lens), less developed sagittal and lambdoid crests (doubtless due to the fact that it is much younger than the type of *osborni*), darker upperparts and a more decided brownish band across the pectoral region.

Upperparts blackish brown, much darker than in *osborni*; underparts blackish brown along the sides and across the throat, forming a darker and broader pectoral band, the central area broadly whitish. Ears and membranes blackish, and in all other respects similar to those of *osborni*. The broad patch of glandular hairs between the ears deep black, fuller and longer than in *osborni* and covering the membrane connecting the ears, but not lengthened into a crest as in *Lophomops*.

Total length, 108 mm.; head and body, 76; tail, 32; forearm, 43.5; third metacarpal, 42.5; third finger, 82; ear from crown, 10; from notch behind antitragus, 17; expanse from tip to tip of both ears, 32.8; tibia, 15; foot, 9.

Skull, total length, 22.2; zygomatic breadth, 12.9; mastoid breadth, 11.5; breadth of braincase, 9.3; interorbital breadth, 4; maxillar breadth, 8.8; breadth at base of canines, 6.7; upper tooththrow (c-m<sup>3</sup>), 7.6; length of mandible, 14; angle to condyle, 4.5; depth at coronoid, 3.7; lower tooththrow, 8.7; transverse extent of lambdoid crest at upper border, 6.7.

Represented by only the type, taken at Faradje, and labelled by the collectors

as "from the stomach of a *Machærhamphus* hawk." The specimen (preserved in alcohol) is practically uninjured for study.

As noted above, *Mops* (*A.*) *faradjius* closely resembles *osborni*, but it has a much shorter forearm, a slenderer body, and, though a male, is somewhat smaller in both external and cranial measurements. It is also markedly darker in general coloration. The type localities of the two forms (Kinshasa and Faradje) are far apart and in regions of widely different environment.

#### 68. *Mops* (*Allomops*) *nanulus* sp. nov.

Type, No. 48864, ♂ ad., skin and skull, Niangara, Belgian Congo, Dec. 12, 1910; Herbert Lang and James P. Chapin. American Museum Congo Expedition. Orig. No. 1318.

Similar in cranial characters and in dentition to *Mops* (*A.*) *occipitalis*, but much smaller and much lighter in coloration.

Upperparts cinnamon-brown; below with the whole median area lighter, the tips of the hairs dull gray with a slight yellowish or buffy tone, the sides much like the back but rather darker; extreme lower back naked or with only a slight pubescence; a thin fringe of bristly hairs from the posterior border of the dorsal pelage, the longer of these reaching to the base of the tail. Wing membranes from the sides of the back, light brown above, somewhat paler apically and on the lower surface. Interfemoral membrane palish brown above and below. Ears of medium size and thickness connected by a low membrane, from the back of which (most prominent in males) is a tuft of lengthened hairs, as in its larger congeners; inner base of ears heavily furred, and otherwise agreeing closely in form and structure with those of *occipitalis*. Tragus small, pointed, black. Antitragus of medium size, broad basally, convex on upper border. Tail short, rather more than the apical half free.

Skull and dentition similar to that of *A. occipitalis*.

Type, collectors' measurements: Total length, 82 mm.; head and body, 61; tail, 21; foot, 9; ear, 15. Forearm (from skin), 28.5. (The type is the largest of a series of 6 specimens.)

Type and 5 topotypes (3 males, 3 females), collectors' measurements: Males, total length, 78.7 (75–82), females, 76 (75–77); head and body, males 58 (56–61), females, 55.7 (54–58); tail, males, 20.3 (19–21), females, 20 (19–21); foot, males 8 (7–8), females 9 (all 9); ear, males 15.5 (15–17), females 17 (16–18). Forearm (from skin), males 28.6 (28.3–28.7), females, 27.4 (27.3–27.6).

Skull (type), total length, 16.8; condylobasal length, 15.5; zygomatic breadth, 10.9; mastoid breadth, 9.6; interorbital breadth, 3.3; maxillary breadth, 7.3; breadth at base of canines, 3; depth (including pterygoids), 5.7; upper toothrow (with canine), 6.1; length of mandible, 11.2; height, angle to condyle, 3.5; depth at coronoid, 2.9; length of toothrow, 6.8.

Skull, type and 5 topotypes (3 males, 3 females): males, total length, 16.5 (16.0–16.8), females 15.4 (15.3–15.6); zygomatic breadth, males 10.3 (10.5–11), females 9.9 (9.8–10). The females are thus smaller than the males, and they also lack the extreme development of the supraoccipital region shown by the males.

Represented by 7 specimens, all collected the same day at Niangara.



This species is readily distinguishable from all other known African molossid bats by its extremely small size, aside from any other characters.

Although the premaxillæ are slightly emarginate behind the incisors, the other characters, both external and cranial, agree completely with the larger forms here referred to *Allomops*, even in the sexual difference, and especially the sexual difference in the size of the lower premolar,  $p_2$  being larger than  $p_4$  in the males and smaller than  $p_4$  in the females.

PART II. NOTES ON THE DISTRIBUTION AND ECOLOGY OF  
CENTRAL AFRICAN CHIROPTERA.

BY HERBERT LANG AND JAMES P. CHAPIN.

These notes are written with the desire of encouraging interest in the bats of equatorial Africa, so that those residing or traveling there may be enabled to recognize many of the species and make additions to their life-histories. Our results give a fair idea of how many forms may still be awaiting scientific description; and a glance at the literature shows, furthermore, that comparatively little is known about their habits.

Small bats need little preparation, since they can be placed in fairly strong alcohol, after having their abdomen opened; and, if the alcohol is changed before shipping, no fear of deterioration need be entertained. The preparation of skins as practised by mammalogists demands some experience.

Our work of collecting systematically started only after we reached Stanleyville, about 1200 miles inland. During five years of uninterrupted field-work in the north-eastern section of the Belgian Congo, the gathering of larger mammals and birds formed the main object of the Congo Expedition. Therefore we could never devote as much time to the study of bats as we should have liked. We profited, however, by every opportunity to increase the scope of our collections and to gather data for a general zoölogical survey. Our efforts with regard to Chiroptera were well repaid, as shown by the list of species in the collection (*antea*, pp. 405-478).

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Bats were collected in 27 localities, which of course include a hundred or more camps and villages within a radius of from 30 to 40 miles of each place. It may be interesting to state that out of the 68 species only 6 were gathered in areas where we spent little time or could not make special efforts. These localities are Cape Lopez, Boma, Malela, Thysville, Leopoldville and Kinshasa; all situated near the West Coast. Three of these forms — from Boma, Malela and Kinshasa — are described for the first time in this paper. All the other species — 62 out of the 68, with 29 newly discovered forms — are from only 12 localities (see pp. 410-413), extending from Stanleyville northeastward to Aba, a distance, as the crow flies, of not quite 450 miles. Since a few other bats have already been recorded from these regions, such an abundance of different forms across a fairly small territory reveals the ideal conditions offered to Chiroptera in Central Africa. (See Map, p. 415.)

Not only is the possession of flight an exceptional feature among Mammalia, but it has always been considered such an effective method of locomotion that zoögeographers excluded bats in drawing their conclusions.

Some species, like *Rhinolophus ferrum-equinum*, were formerly believed, even by scientists, to extend uniformly over Europe, Asia and Africa. Of late, however, they have been divided into numerous distinct forms, for in recent years the characters on which distinctions can be based have received more careful consideration. These facts should have a stimulating effect upon collecting, since it is certain that, just as in birds, there are many local species.

Exact information as to the number of species of Chiroptera from the Ethiopian region is not available, but in the whole world there are recognized at present, according to G. S. Miller (1907), "about 900 forms of Chiroptera, a number probably representing considerably less than half of what will eventually be known." Andersen's 'Catalogue of Chiroptera' enumerates 228 forms of fruit-bats, among which are 32 Ethiopian species (34 forms).

A few remarks about the distribution of fruit-bats after our long field experience in eastern and western Africa may clear up some of the intricate details of their range. More than two-thirds of all the fruit-bats known in the Ethiopian region, that is 25 forms, are recorded from the West African province ("Great West African Forest Tract, south to Damaraland, east to Victoria Nyanza,"<sup>1</sup> and north to the borders of the Sudan); and only ten species from the huge eastern and southern portion. Four of them (*Eidolon helvum*, *Roussettus ægyptiacus*, *Epomophorus gambianus*, *Epomophorus anurus*) overlap with those of the West African province. Two species occur only in southern Arabia and one only on the Island of Pemba. The latter is a representative of the genus *Pteropus*, elsewhere unknown in the Ethiopian region. It tends to show, together with Malagasy fruit-bats and other island forms, the isolating influence of the sea, to which the species occurring on the islands off the West Coast do not submit, for all the fruit-bats of Fernando Po, St. Thomas, and Annobon belong to the same forms as those of the neighboring mainland.

A review of the principal physiographic features involved will probably offer the best explanation of their distribution. The West African rain-forests extend from the shores of the Gulf of Guinea, with a slight interruption near the Gold Coast, eastward to the foot of the Ruwenzori, over a distance of 3000 miles, and form at places a sector more than 400 miles wide (see map, p. 415). The relative absence of important mountains, the generally slight elevation, the typically moist equatorial climate with little or no well-marked seasonal change, are factors that have facilitated the even dis-

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<sup>1</sup> Andersen, Knud. Catalogue of the Chiroptera. Vol. I. Megachiroptera. London, 1912. p. lxxvii.



persal of flora and fauna to such a degree that uniformity, one might almost say monotony, has become the hall-mark of this great forested complex. In later years botanists have confirmed the view that in spite of its luxuriant diversity of forms the flora of this rain-forest in its general composition is fundamentally the same over its entire extent. Many of its important elements are even represented far beyond its confines, in the wooded extensions along the larger affluents of the rivers draining the territory.

As shown previously, fruit-bats are naturally more common in regions covered by rain-forest, where fruit ripens throughout the year, than in more arid regions, where such fruit-bearing trees as furnish food for these bats are rarer and one crop of fruit is the rule. These latter regions have well-marked rainy and dry seasons. Fruit is naturally scarcest after the annual fires have slowly eaten across the country and left the shrubs and trees leafless and the fields in such a barren condition that a comparison with the effects of heavy frosts in temperate climates suggests itself. Within a very short time the grass sprouts again and flowers often cover the trees before the leaves have appeared. It is of great importance that only a few degrees north of the equator the seasons happen to be the reverse of what they are at that time south of the equator. Furthermore the essential elements of the flora remain nearly the same over the entire eastern and southern Ethiopian sub-regions. Thus the fruit-bats of these districts, by adjusting their migratory flights, might easily escape the unpleasant and otherwise inevitable conditions of an annual famine. In fact the power of flight could bring them within the fragrance of ripening fruit throughout the year, if they but chose to travel across country between 5° south and 5° north of the equator. Such migrations are wholly within the powers of fruit-bats. Since fruits are not always equally plentiful, they have to shift continually even in the rain-forest. They have nowhere well established roosts, nor are they present in numbers for a long period in any region except where cultivation of non-autochthonous fruit-trees helps provide an ample food-supply throughout the year, as in many eastern and western coastal districts. Though no positive observations with regard to regular migrations are on record and only "large flights" and "great numbers," without date or locality, are found in the descriptions of various travelers, the occurrence of several species (*Eidolon helvum*, *Roussettus leachi*, *Roussettus aegyptiacus*, *Epomophorus wahlbergi*, *Epomophorus anurus*) across the eastern and southern portion of the Ethiopian subregion would be a good reason to suggest migration as the only possible solution of their presence throughout the entire territory, where they would have to starve should they remain in one region throughout the year.

The following detailed notes on the species collected by the Congo

Expedition prove that the range of many of these fruit-bats extends, as might be expected, across the entire West African province. Of the larger and more gregarious forms, that for many reasons can be more easily observed, we know with certainty that they are found not only across the rain-forest but far beyond into the drier regions in many of the larger forested galleries. The range of several of the small and rarer forms known only from a few localities was considerably enlarged by our observations and will undoubtedly be still more extended as the knowledge of African bats increases through the more detailed results of further explorations.

Fruit-bats of course reach much larger dimensions, and their body is relatively heavier, than is the case with insectivorous bats. But size alone offers no real point of distinction, as is shown by a comparison of the measurements of the largest and smallest African bats of each group.

<i>Fruit-bats</i>	<i>Total length</i>	<i>Wing-spread</i>
Hammer-headed bat ( <i>Hypsignathus monstrosus</i> ), male	10.25 inches	3 feet 2 inches
Pygmy fruit-bat ( <i>Megaloglossus woermanni</i> )	2.75 inches	10.25 inches
<i>Insectivorous bats</i>		
Black hawk-bat ( <i>Saccolaimus peli</i> ), female	6.1 inches	2 feet 3 inches
Mouse pipistrelle ( <i>Pipistrellus musciculus</i> ), female	2.5 inches	6.5 inches

The Malay flying-fox (*Pteropus edulis*), measuring one foot in length and 5 feet across its fully expanded wings, holds the record for size among the Chiroptera.

Dull shades of brown generally predominate in the fur of African fruit-bats and help to render them inconspicuous when at rest. To distinguish them at once from their insectivorous compatriots, two external characteristics give ready clues.

1. The form of the ear (Fig. 1, *B*, p. 407), with its borders coming together below, differs from that of insectivorous bats, where a space intervenes between the lower edges of the anterior and posterior margins (Fig. 1, *A*, p. 407).

2. The second digit, forming the edge of the wing, bears a terminal claw (Plate XLIV, Fig. 1), not present in any insectivorous bat.

The thumb is long and well developed, bearing a claw as in all other bats, but here sufficiently strong to sustain their weight when climbing about on the branches. It is also used, together with the foot, to help hold the fruit when feeding, thus really functioning as a finger. The claw on the second digit considerably increases the use of the wing as a hand. The third finger is always the longest, the fourth and fifth the shortest. In *Eidolon helvum*, which has the widest distribution and is also the greatest traveler among African fruit-bats, the third digit is especially long and the

fifth rather short, thus forming a long and narrow wing, much better suited for its long flights. In epomophorine bats, however, the fourth and fifth digits nearly equal the third; the resulting broad wing intimates, as we have often observed, that their flight is more irregular. A rather heavy wing adapted for relatively slow flight is characteristic of all fruit-bats; the membranes are never transparent, but usually dark,—brown or almost black,—yellowish only in *Casinycteris*. These membranes are very extensible. They are folded around the body not only as a protection against the rain but also, when hanging on leafless branches by the hundreds (*Eidolon helvum*), to shield the eyes against the glaring sun.

The tail is either much reduced or totally missing, and instead of a continuous caudal membrane we find only rudimentary borders along the inner side of the legs. Thus they are devoid of any such efficient steering apparatus as that which a long tail supporting a large membrane would offer, and have only their long legs to rely upon for turning. With them flight is only a means of travel from tree to tree to secure fruit and is not needed for the rapid and eager pursuit of fast-flying prey, so great a necessity to all insectivorous bats. The comparative simplicity of the outer ear, and the lack of highly developed sense organs in their wing-membranes are noteworthy facts. Contrary to the behavior of insectivorous bats the larger fruit-bats, when let loose in a room, fly against obstacles and windows with the same injurious effects as birds.

Sexual characteristics are, as a rule, more pronounced in fruit than in insectivorous bats. The larger size of the males (p. 502), the huge ossified larynx (pp. 501 and 505), and the glandular patches of conspicuously colored hair (p. 512), will be mentioned in the notes under the various species.

Since fruit forms their only food, it is hardly possible that their eyes alone, though relatively large, should suffice to discover it, especially as much of the wild fruit is hidden beneath the dense canopies of the larger trees. Their great flights, resembling migrations, have been pointed out under notes on the various species and are undoubtedly undertaken in search of ripe fruit. From our observations we feel sure that their sense of smell is very highly developed and our experiments show that it is probably their principal guide, since the fragrance of ripe fruits is often very strong. In nearly all fruit-bats the nasal region is extremely long, with well-developed ethmoids as a special provision for the highly sensitive organs of smell. The large olfactory lobes (Fig. 20, p. 507) also show that smell with them is a very important factor.

The skull with very few exceptions (p. 511) is elongate and rather smooth in outline. The brain-cavity is comparatively small, a certain sluggishness in temper and action distinguishing them from the more active in-



sectivorous bats. The mandible with its long, interrupted tooth-row is slender and weak, and is operated by rather poorly developed jaw muscles. The canines are fairly long, rather dull, and often round in transverse section, fit for wrenching off, cutting open the fruits, or holding them in the mouth during flight. Their cheek-teeth, with crowns often narrow, are rather degenerate and are chiefly of assistance in separating the pulp from the fiber, as in mangoes, or in squeezing out juices from the pulp. Their food requires little or no mastication.

The very extensible tongue is beset above with gustatory and tactual papillæ. The latter are often arranged in a patch near the tip, tridentate and stiff enough to serve as a rasp (Fig. 16), helpful in gathering pulp and juices from inside the fruits after their outer cover has been torn. In some species juices of fruits are also sucked by means of extensive pouches underneath the lips (Fig. 18, p. 503).

The digestion must be extremely rapid (p. 499) and the quantities of fruit or their juices consumed large, hence the great patches of apparently fresh pulp, together with the remnants of spoiled fruit, underneath boughs that seem to be used as habitual dining-halls (pp. 501 and 504).

The destruction they cause may be considerable; but by transporting these fruits, sometimes to a distance of several hundred yards, before feeding upon them, they naturally distribute their seeds. These sprout readily and grow into trees under the favorable influence of the moist climate. Valuable fruit-trees are planted in this way beyond the confines of the cultivated area of the posts. Since the larger species (*Hypsignathus monstrosus*, *Eidolon helvum*, and *Epomophorus franqueti*) habitually move fruits as large as figs or guavas in fairly great quantities we can easily imagine what an important rôle fruit-bats play in the propagation of certain fruit-bearing trees throughout the West African rain-forest. It may even surpass any similar agencies of monkeys and birds that usually receive all the credit in this line. *Eidolon helvum* with its flocks of thousands dropping into a country in search of ripe fruit should certainly be an effective factor for the dissemination of many forms, such as wild figs (*Ficus*).

In the West African province they cause no devastation whatsoever to native plantations, since the negroes there plant not a single indigenous fruit-tree. Palm-nuts are not attacked, in fact the tastes of these fruit-bats coincide somewhat with those of the human race. Sweetish, acidulated, or juicy pulp are their chief aim, and therefore the fruits of trees imported by Arabs or white men are especially liable to be attacked. It is true that they are very fond of plantains and bananas, but these are cut when in a green state and are then absolutely unpalatable to fruit-bats. Only after they have ripened underneath the roof of native huts are they stolen by these tiny gourmets.

The insectivorous bats in this collection, represented by 60 forms as against 8 of fruit-bats, give a fair idea of their relative predominance, since both kinds were collected under equally favorable circumstances. From the number of species described we have reason to think that the same proportion, which we found between fruit and insectivorous bats in the northeastern section of the Congo basin, holds good for the entire West African sub-region. We might thus account for about 180 species of insectivorous habit in contrast with only 25 of fruit-bats within the same boundaries. Extending the same ratio still further, some 250 species of Microchiroptera may be found to inhabit the entire Ethiopian region; this is considerably more than are recognized at present.

Yet in spite of their variety the insectivorous bats of the Ethiopian region do not show as wide a differentiation as those of the Neotropical region. There is not a single blood-sucking form (Desmodontidæ) in Africa, though the large herds of game might be cited as offering opportunities for such feeding habits. Although there is not a single fruit-bat (Pteropodidæ) in the Neotropical region in spite of the large number of fruits in its equatorial forests, nevertheless one family of the Microchiroptera, the Phyllostomidæ, has developed several fruit-eating genera. South America also has fishing bats (Noctilionidæ), though positive evidence of bats feeding on vertebrates has yet to be offered for Africa. Pechuel Loesche records from Damara-land (South West Africa), having "found repeatedly in places (caves), where bats slept, fresh remains of small lizards, birds, and even Chiroptera."

Though far richer in species, these insectivorous bats were never such a

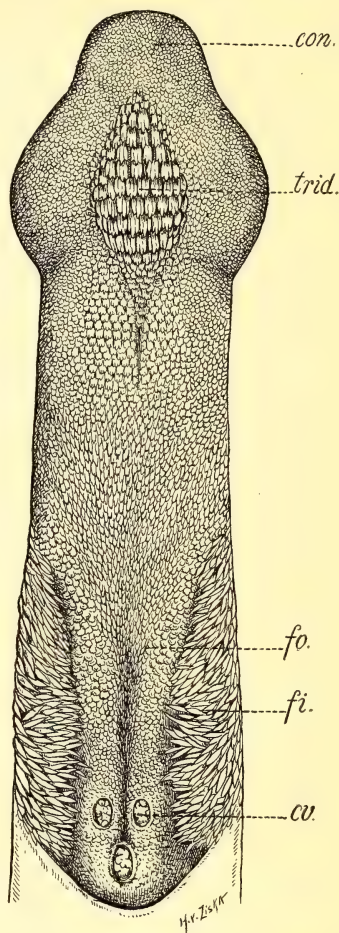


Fig. 16. *Hypsignathus monstrosus*. Tongue of adult male (No. 48657), from above.  $\frac{2}{1}$ . It shows the form, when extended, characteristic in life. *con.*, conical; *cv.*, circumvallate; *fi.*, filiform; *fo.*, foliate; *trid.*, tridentate papillæ.

noticeable feature of the crepuscular landscape as the larger fruit-bats. The latter really command attention by their great flights continuing for weeks at a time across country. Their noisy voices cannot be compared with the faint squeaks of even a dozen hawk-bats (*Saccolaimus peli*) though they may appear regularly on the village square. Hardly anybody pays attention to the few little bats (*Hipposideros*, *Nycteris*, *Rhinolophus*) that occasionally enter lighted rooms. By infesting double-roofed houses or uninhabited rooms, they make themselves a nuisance, since the smell of their excrement soon becomes unbearable in the moist atmosphere. When emerging from their dusky places of refuge, they scatter over the landscape so that even on clear, moonlight nights one seldom sees more than 20 or 30 hunting, each one separately. They never appear in such numbers as feeding flocks of swallows, swifts or bee-eaters, even near places where their colonies are large.

The families of African insectivorous bats have no great preference for either rain-forest or bushveldt. All of them, except the Megadermidæ and Rhinopomidæ, furnish an almost equal number to both zones. The species are perfectly endemic to either, just as distinct at least as birds of the forest and birds of the plains. The kinds of insects these bats feed upon in either area are perhaps the decisive factor that makes them stay in their respective environments. With this in view the species contained in the present collection may be classified as follows:

		Habitat chiefly		
		in forest	in bushveldt	in both
Emballonuridæ.....	4 species	1	2	1
Nycteridæ.....	5 "	2	2	1
Megadermidæ.....	1 "	—	1	—
Rhinolophidæ.....	9 "	3	5	1
Vespertilionidæ.....	22 "	10	11	1
Molossidæ.....	19 "	9	10	—

The following 24 forms are characteristic of the rain-forest. Some are still found as far as fifty miles beyond its confines in the more extensive forest galleries.

#### *Emballonuridæ*

*Saccolaimus peli*

#### *Nycteridæ*

*Nycteris avakubia*

" *arge*

#### *Rhinolophidæ*

*Hipposideros caffer niapu*

" *langi*

#### *Vespertilionidæ*

*Myotis bocagii cupreolus*

*Pipistrellus musciculus*

*Scotozous rüppelii*

*Eptesicus tenuipinnis*

" *minutus minutus*

*Mimetillus moloneyi*

*Pachyotus nigrata nux*

*Glauconycteris humeralis*



<i>Glauconycteris alboguttatus</i>	<i>Chærephon russatus</i>
<i>Kerivoula cuprosa</i>	<i>Nyctinomus aloysii-sabaudiae</i> (?)
<i>Molossidæ</i>	<i>Mops congicus</i>
<i>Myopterus albatu</i> (?)	“ <i>niangaræ</i>
<i>Nyctinomus leonis</i>	“ <i>occipitalis</i>
“ <i>ochraceus</i>	“ <i>nanulus</i>

Bats living in the open country or bushveldt, like certain birds from the plains (Bishop-birds, etc.), are also found occasionally within the borders of the forest where extensive human settlements have entirely altered conditions. The following 32 forms, however, were collected only in the bushveldt.

<i>Emballonuridæ</i>	<i>Eptesicus ater</i>
<i>Taphozous sudani</i>	“ <i>faradjius</i>
<i>Coleura gallarum nilosa</i>	“ <i>garambæ</i>
<i>Nycteridæ</i>	<i>Scoteinus schlieffeni</i>
<i>Nycteris pallida</i>	<i>Pachyotus altilis</i>
“ <i>major</i>	<i>Glauconycteris papilio</i>
<i>Megadermidæ</i>	<i>Miniopterus breyeri vicinior</i>
<i>Lavia frons affinis</i>	“ <i>inflatus</i>
<i>Rhinolophidæ</i>	<i>Molossidæ</i>
<i>Rhinolophus hildebrandti eloquens</i>	<i>Nyctinomus ansorgei</i>
“ <i>abæ</i>	“ <i>cisturus</i>
“ <i>axillaris</i>	“ <i>frater</i>
<i>Hipposideros abæ</i>	<i>Chærephon</i> ( <i>Lophomops</i> ) <i>chapini</i>
“ <i>nanus</i>	“ “ <i>cristatus</i>
“ <i>gigas niangaræ</i>	“ “ <i>abæ</i>
<i>Vespertilionidæ</i>	<i>Mops midas</i>
<i>Myotis bocagii bocagii</i>	“ <i>trevori</i>
“ “ <i>hildegardæ</i>	“ ( <i>Allomops</i> ) <i>osborni</i>
<i>Pipistrellus abaensis</i>	“ “ <i>faradjius</i>

Furthermore there are five species that have a much wider distribution than those mentioned previously. They are at home in the rain-forest as well as in the open country because they follow closely in the wake of man and live either in the native plantations (*Pipistrellus nanus*, *Myotis bocagii*) or in and about human dwellings (*Taphozous mauritanus*, *Nycteris hispida*, *Hipposideros caffer*).

The distribution of insectivorous bats is greatly influenced by the fact that most of them have definite roosting-places. They are not typical vagabonds, like the fruit-bats, wandering about the country for the sake of a meal. On the contrary, their food-supply is so abundant everywhere and at all times that good places of refuge are apparently the only requisite for the establishment of their colonies. In these regions, wherever one sees hills, with suitable clefts or caves, or big hollow trees, one is practically

sure to find insectivorous bats; but on the level and barren plains, one is just as sure to find very few. They sometimes shun trees or other places infested by ants, the winged individuals of which they readily devour, and yet they inhabit trees housing termites, which seem not to molest them. Far from minding the company of flying-squirrels (*Anomalurus* and *Idiurus*) or of geckoes (*Hemidactylus*), they are often found living with these.

Those with gregarious tendencies have so many traits in common that one looks in vain for differences in their behavior caused by diversity of environment. On the borders of the dry regions of the Sudan or in the moisture-laden rain-forest their habits seem in all essentials the same. They may flock together, sometimes only half a dozen in a small knot-hole, or several hundred in a large hollow tree or rocky cleft. Caves may attract thousands but all these colonies are made up habitually of members of but one species. Night after night they return to their accustomed roosts, which they do not abandon even when frequent raids made upon them by the natives have thinned out their numbers. Large, juicy lumps of fat, deposited in and about their abdominal cavity, stimulate the natives to kill all they can.

Native traditions, and still more the thick layers of guano in some of the caves and beneath the rocky clefts, would tend to justify the belief that many of them die where they are born. This is fully confirmed by the records of *Rhinopoma microphyllum* living by the thousands in the Pyramids. Anderson (Zoology of Egypt, Mammalia, 1902, p. 148) offers proof of their having lived and bred there for nearly 3000 years without showing any perceptible changes.

The species of Molossidæ which we found have a relatively limited range. Among them gregariousness is the ideal mode of life and they huddle together in lumps. Often they exhale a disagreeable odor that might possibly help them to find each other more easily. Our observations would tend to show that they probably are polygamous, although data from other countries indicate that males and females of this family form separate colonies, at least at certain seasons. The Emballonuridæ show stronger propensities for society than the Rhinolophidæ. Of the Vespertilionidæ only a few species form really large colonies. Houses and similar structures which offer the same advantages as their natural abodes are readily invaded by such bats.

All these bats that live in colonies and rest with feet and wings against the walls (p. 549) and climb over each other, have short smooth appressed, rather lustrous hair. With all the Molossidæ, at least, we find this to be true. Among the Emballonuridæ, *Saccolaimus peli* and also *Taphozous mauritanus* are good examples, though they rest singly. Even *Eidolon*

*helvum*, the only fruit-bat we found hanging up in clusters, has short, somewhat glossy hair different from our other fruit-bats.

These features seem so important a characteristic that one can set apart nearly all the other bats that have loose, rather long and sometimes frizzled hair. These hang perpendicularly, suspended by only the claws of their hind limbs, each one by itself. Sometimes they live in hollow trees and form colonies (*Hipposideros langi*) but never huddle together in bunches. Caves or houses may shelter them in great numbers (*Hipposideros abæ*, *Hipposideros caffer*). Others hang one by one on branchlets (*Lavia frons affinis*) or hide in dense clusters of leaves (*Eptesicus faradjius*, *Glauconycteris papilio*), or rest in the vegetation of swamps beneath the crown of papyrus (*Nycteris pallida*). One would include in the long-haired groups also such solitary bats as *Kerivoula cuprosa* and *Pipistrellus musciculus*, that crawl into knot-holes, and those that seek refuge in bunches of plantains (*Pipistrellus nanus*, *Myotis bocagii*).

A few remarks on certain conditions in these territories which especially influence the food-supply of insectivorous bats will probably add to the better understanding of their life-histories.

The equatorial rain-forests with their moist, even temperature of about 100°, changing as little in the lapse of 24 hours as during a twelvemonth, offer conditions to them that could hardly be more favorable. Neither the bats nor the insects upon which they feed have there to submit to such inhibitory influences as would be caused by hibernation or estivation. The great humidity also prevents such catastrophes as the spreading of fires.

The forested galleries are like promontories pushed far out into the drier regions, where annual grass-fires have stunted the growth to such an extent that the large hollow trees in these moist tracts or along the rivers represent the only opportunities for roosting. The vicinity of water, especially the open sheets with their abundance of crepuscular insect-life, are undoubtedly an invaluable adjunct. These forested belts also act as an effective barrier against the destructiveness of the grass-fires and, being the only luxuriant places amidst the scorched fields, they become a haven of refuge for millions of insects.

The open country or bushveldt, with grass growing to a height of 5 to 14 feet, has 15 to 25 percent of its surface covered with bushes and low trees; usually not attaining more than 30 feet in height. A few still larger ones are scattered widely between. Shortly after the end of the rainy season, in December and January (in the northeastern Congo basin), the impeding and now useless minor vegetation is set on fire as an annual house-cleaning.

To insectivorous bats such extensive grass-fires mean wholesale destruction of their food-supply. Millions of insects are then wiped out. Small



forms, trying to escape as the crackling of exploding grass-stalks comes nearer, are carried high up into the air by the heat-waves. Here they are preyed upon even by the bats, which in the Uele district are often attracted to the fires in the night, just like swifts, swallows and other birds during the day. But most of these insects are carried far away and alight undoubtedly along the areas not destroyed by the flames. During this conflagration bats are more plentiful in the neighborhood of rivers and such species as formerly sought protection in the clusters of green leaves are suddenly forced to look for other hiding places. At Faradje on the Dungu River, when the trees were leafless, we observed that some bats not seen before about human settlements came to the houses (*Eptesicus faradjius* and *Glauconycteris papilio*). Even *Lavia frons affinis* which keeps to the open plains throughout the year was more numerous in the trees about the post, and *Taphozous mauritianus* likewise increased in numbers.

Travellers that happen to camp, during this season, away from streams and surrounded by the blackened soil might look in vain for bats. Shall we wonder that *Lavia frons*, the species most ubiquitous over the equatorial bushveldt, has learned to care little for cover and often hunts in bright sunlight? Is it surprising that it feeds upon Coleoptera so large, that it seizes them one by one? In its habitat tender insects that could be gathered in rapid flight by the dozens may become scarce at times.

Since their crepuscular and nocturnal habits of feeding have so vitally influenced their structure, it is not without importance to state that, as a rule, only those insects which disport themselves in full flight during at least a few hours of darkness can make up their bill-of-fare. If we think of the nuptial flights of termites, so abundant as to form a staple food even for natives, of the clouds of mosquitos, of the numbers of roaches, crickets and moths we realize that the supply exceeds the demand. From examinations of their stomachs, we know that, besides Isoptera, Diptera, Orthoptera and Lepidoptera, many Hymenoptera, Hemiptera, and especially Coleoptera, furnish a very large share of their sustenance.

The food of each species consists undoubtedly of a great variety of insects, a selection influenced probably by their seasonal abundance. In the bushveldt their sudden appearance in great numbers is a very noticeable feature. They seem to come and go with the growing and perishing of the minor elements of vegetation, following well marked seasons. Yet in the seasonless rain-forest such cycles of great profusion seem equally common.

A few bats may gather at least a part of their food, such as small roaches and spiders, in clambering about fruits and between the leaves. Of this we suspect especially *Pipistrellus nanus*, which would be greatly helped therein by its crawling propensities (p. 530).

As we might expect from such highly specialized forms, insectivorous bats at times display abilities which place them among the most successful predatory types. Their brain-case is comparatively large, and their skull shows a greater diversity in form than that of any other suborder of the Mammalia. It clearly demonstrates how feeding-habits and the food to be masticated or digested completely change the shape of the skull, the dentition and, in some cases, even the digestive organs (Phyllostomidæ, Desmodontidæ). Among the bats of the Ethiopian region we cannot point out equally striking differences, but two skulls illustrated in this paper show the point in question. The heavy skull of *Mops (Alloimops) osborni* (Fig. 12, p. 470), with an enormous sagittal and lambdoid crest, is capable of giving strong support to large muscles of mastication. They are needed to operate the broad grinding, cutting surfaces of the short dental rows. The food of all such Molossidæ consists chiefly of hard-shelled insects. On the other hand the globose, smooth skull of *Kerivoula cuprosa* (Fig. 8, p. 452) offers support for only small muscles. The rostrum is strongly pinched together. The teeth are narrower, and the tooth-rows and palate longer. Their food consists of tiny mosquitos and similar insects.

The great width of their gape (p. 531) assists them in feeding rapidly, for many of these insects disappear as quickly as they come. This wide-open mouth acts as a net and every insect entering is instantly put to death by the sharp dagger-like canines. The short tooth-row serves as an exceptionally efficient milling apparatus. They literally cut and grind their prey to dust with a few bites, an exceptional advantage when we consider that speedy digestion is thereby made possible. For only by pulverizing or separating their food in this manner are the muscles of these minute and often hard-shelled insects instantly exposed to the digestive fluids. Bats, having no crop like a bird in which to store away their food, thus succeed in extracting all there is in the food in the quickest possible manner. We observed *Hipposideros gigas niagaræ* feeding on termites so ravenously that, after filling its stomach, it tucked into its cheeks all they could hold. It also had its mouth full when shot.

The wings show considerable variety and are either narrow and pointed, as in those that fly as swiftly as swallows, or are broad and rounded, as in those that flutter about apparently in the aimless fashion of butterflies. They all have a short, clawed thumb (p. 549) and four greatly elongated fingers which "serve like masts that keep the canvas of a sail spread and regulate its motions," as Goldsmith picturesquely writes.

Besides serving as mere supports during flight, the wing and inter-femoral membrane have another very important function. Together with the large nose-leaves and curiously modified ears of certain species, they

act as highly sensitized organs. They seem to feel and in reality must be able to measure certain waves, so that it appears as if they could see and hear with them as well. The experiments of Spallanzani have shown that even if blinded they will not strike in flight against any solid object except when thoroughly exhausted. When chasing them in closed rooms, we often have seen them escape in full flight and apparently unhampered by narrow slits in the windows and doors through which we thought they could hardly crawl. Dobson believed that long-eared or leaf-nosed bats prefer darkness, but the Megadermidæ, with the largest nose-leaves and ears, are semi-diurnal; the Nycteridæ, with these appendages still fairly elaborate, we found to be rather crepuscular. Yet *Taphozous* with no nose-leaves at all, generally hung in relatively light places throughout the day, and was one of the last to fly out. Their behavior depends evidently on feeding-habits or on the abundance of their victims at such hours.

At Faradje where *Taphozous mauritanus* was common we found great numbers of moth-wings beneath places where they were accustomed to rest. These evidently were habitually rejected before feeding.

The interfemoral membrane, really their third sail (p. 516), is well developed in all African families of Microchiroptera, except in the Rhinopomidæ. It undoubtedly increases the steering facilities which, by stretching out or pulling in the limbs or shifting the tail, play such an important part in the capture of insects, all of which have their own peculiarities of flight. The full stomach of bats shot on the wing furnish evidence that their erratic flight cannot be entirely ascribed to their inability to progress with ease. On the contrary, we are prompted to look upon their meanderings as an exhibition of great dexterity where flight of any kind is but the means to a successful end. Entomologists, who will remember how often they looked longingly after an insect that they endeavored to capture in full flight, are probably the most qualified and willing to assent to such a statement.

Secondary sexual differences amongst insectivorous bats are far more varied than in fruit-bats. They are however much less conspicuous and depend mostly on specific characteristics. Under these circumstances we find it best to refer to the field notes, where we have pointed out all those that came to our attention. These are:

- 1, the larger gular pouches of the males of *Taphozous mauritanus* (p. 513);
- 2, the larger size of females of *Saccolaimus peli* (p. 515);
- 3, the dorsal glands in males of *Lavia frons affinis* (p. 520);
- 4, the possession of a frontal sac and abdominal appendages in *Hipposideros caffer* (p. 524);
- 5, the curious anal sacs of *Hipposideros langi* (p. 526);



6, a crest, sometimes larger in females, as in *Chærephon frater*, or present only in males as in *Chærephon (Lophomops) abæ* (pp. 547 and 553);

7, the higher sagittal crest of the skull in some males, as of *Mops (Allo-mops) osborni* (p. 470);

As a rule, all the Chiroptera have one young, but from several records we conclude that two may occur occasionally in all species. Most bats in these regions breed throughout the year, but a definite breeding season may exist in such gregarious forms as *Eidolon helvum* (p. 497) and *Nyctinomus ochraceus* (p. 546) and perhaps in most of the Molossidæ.

Besides man the rather rare bat-hawk, *Machærhamphus anderssoni*, is their most important enemy (Plate LV). Fast flier that it is, bats still know how to dodge it. It cannot pounce upon them successfully except when high above the dense canopies of the forest or over wide expanses of water.

#### APPENDIX A.—NATIVE BELIEFS AND INTEREST IN BATS.

Since, in making these collections, we profited much by the information gathered from natives, it may be well to state a few of their beliefs. With their fondness for generalizations they consider all bats birds though they readily distinguish two categories: the larger fruit-eating kinds that bite like a dog and the smaller insectivorous bats that fly about like swallows and have needles in their mouth.

The lack of meat-producing herds of cattle, with dogs and chickens only as a meagre substitute, and with cannibalism practically abolished, have helped to develop in these Congolese negroes an interest in the haunts of bats. They are still a more satisfactory animal food than grasshoppers or caterpillars. The smaller species inhabiting hollow trees, rocky clefts or caves on account of their large number are as welcome as the larger fruit-bats. The native says the former live in villages but if he finds fruit-bats hanging together in clusters (*Eidolon helvum*) he believes they assemble so as not to get wet from the daily rain, and is quite amused that the younger ones, having to hang outside, complain and scold continually. The negro also knows that fruit-bats hear well when asleep, for he has observed that they move their head, no matter how cautiously approached. They seem to be unable to discover the native who, shooting a few with an arrow, considers all of them blind during the day.

Though hardly any species is rejected as too small, the Molossidæ, forming large colonies, contribute much to the fame of bats as delicacies. These natives consider disagreeable odor an advantage and fat flatters their palate. Spiked on a splinter of wood, singed and broiled over the fire, the

bowels left in as a condiment but pressed out just before serving make them choice morsels. Meat and bones are crunched with delight. The canines of insectivorous bats, of which the natives speak as needles, are removed with great care for, according to general belief, they would pierce the stomach, with sure death as a result. Among the Mangbetu the fat, wrinkle-lipped bats (*Molossidæ*) are often brought to the king as a special delicacy. Roasted and arrayed in rows of five and ten on a rod, they make a very welcome present, but should one forget to break out their needles he would be guilty of the gravest offense. Suspected of an intention to murder the king, his days would be numbered.

#### APPENDIX B.—EXTERNAL CHARACTERS OF THE FAMILIES OCCURRING IN THE ETHIOPIAN REGION.

The *Rhinopomidæ*, with one species inhabiting Egypt, are not represented in our collection, but we wish to give the chief external characteristics of all the 7 families of *Microchiroptera* known from the Ethiopian region. *Rhinopoma*, the only genus, is easily distinguished from all other bats by its slender tail (Fig. 17, *A*), nearly as long as head and body together and greatly surpassing the very small interfemoral membrane, and by the presence of two phalanges in the index-finger.

The *Emballonuridæ* are represented by only a few species. The hair of the body may frequently be short and appressed but never very long. The muzzle is slightly elongate, the nostrils simple, the eyes relatively large, and the ears erect with small rounded tragus (Plate XLIX). The legs are slender, the wings curiously folded when at rest (Fig. 21), the wing-membranes either dark or translucent. The tail always projects above the large interfemoral membrane (Fig. 17, *B*), it fits so loosely in the wrinkled skin that it can often be withdrawn (p. 515). They are extremely fast fliers and can turn with exceptional ease.

The *Nycteridæ* are a small family. The body is covered with rather long, loose fur, the nose-leaves conceal a frontal pit, the lower lip has a warty tip, the ears are large with a small tragus, the eyes small (Fig. 3, p. 426). The long tail supports the large uropatagium and terminates in a Y-shaped tip (Fig. 17, *C*). The wings are broad.

The *Megadermidæ* are known from only a few forms. We refer to the notes on *Lavia frons affinis* (p. 520) and also to Fig. 22 and Plate L. The large nose-leaves with long bifid tragus, and the shortness or lack of a tail are the chief characteristics of this family. Their semi-diurnal habits are especially noteworthy.

The Rhinolophidæ are a large family. The body is covered with relatively long hair, that sometimes appears frizzled; a Y-shaped, short-haired area on the back is typical of some forms. Horseshoe-like, complicated nose-leaves (Plate LI and Plate LII, Fig. 1) are especially characteristic. The large ears are without a tragus, the moderately long

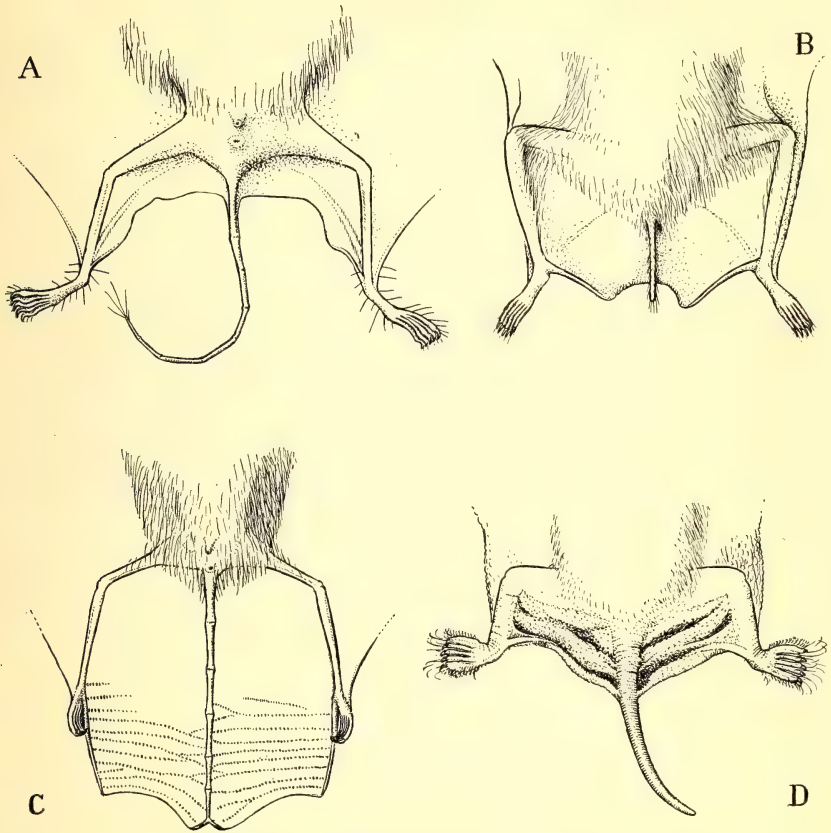


Fig. 17. Interfemoral membranes: A. Rhinopomidæ (*Rhinopoma microphyllum*), from beneath; B. Emballonuridæ (*Taphozous mauritanus*), from above; C. Nycteridæ (*Nycteris arge*), from below; D. Molossidæ (*Nyctinomus ansorgei*), from above. All  $\frac{3}{4}$ . For interfemoral membrane of Megadermidæ, see Fig. 22 (p. 537); of Rhinolophidæ, Figs. 5 and 6 (pp. 436, 437); of Vespertilionidæ, Figs. 7 (p. 448) and 22 (p. 537).

caudal membrane is supported to the very tip of the tail. Their flight is rather spasmodic, but swift. They feed on a great variety of insects.

The Vespertilionidæ represent the largest group and comprise the ordinary bats of temperate climates. This family consists mostly of small forms, with loose fur, a short head, small nostrils terminating in an obtuse



muzzle, no nose-leaves, relatively small eyes and ears, the latter placed on the side of the head, with slender, nearly straight tragus. The wings are fairly broad, with two phalanges in the middle finger. The color of their membranes may be either dark, transparent, or even vividly colored. The interfemoral membrane is especially wide and supported to its very tip by the tail-vertebræ. Most of them feed on very small insects, and some, like *Pipistrellus*, take mosquitos. *Mimetillus*, having short appressed hair and narrow wings like the Molossidæ, is to be noted as an exception (Fig. 22).

The Molossidæ are rather common. They have short appressed body-hair with a peculiar velvet-like luster in life. The head is rather thick and clumsy, the muzzle obliquely truncate, the small nostrils usually terminate in a pad, but without nose-leaves. The ears may be erect and separated (Plate LIII, Fig. 2) but more often join across the forehead and project beyond the tiny eyes (Plate LIII, Fig. 2). Their posterior borders extend far down on the cheeks and the tragus is small. The wings are very narrow, their tips folding underneath (Fig. 25) or above, the membranes dark, light or transparent. Typical of this family is a separate narrow band of fur near the inner edge of the wing-membrane on its lower surface, extending from the armpit to the thigh and usually of the same color as the belly. The tail projects considerably beyond the edge of the interfemoral membrane, its skin thick, fitting loosely over the vertebræ (Fig. 17, *D*). The heavy, short feet are free from the membranes; but the spoon-hairs on the two outer toes are characteristic (Fig. 26); those on the wrinkled lips are often very minute. Their flight is extremely swift and rather continuous, with turns less rapid than the Emballonuridæ. They generally feed on hard-shelled insects.

## PART III. FIELD NOTES.

BY HERBERT LANG AND JAMES P. CHAPIN.

## MEGACHIROPTERA.

## PTEROPODIDÆ.

1. ***Eidolon helvum*** (Kerr).<sup>1</sup>

Plate XLIV, Fig. 3.

The color of this large fruit-bat when adult is a distinctive dirty yellowish brown with deeper orange tawny hair on the glandular skin on the front of the neck, especially in males. The small free tail is decidedly variable in length, from .25 to .80 of an inch (6 to 20 mm.). In contrast to the epomophorine bats it has a more pointed head, like that of the flying-foxes; the wings are long and narrowed, and spread about 30 inches (755 mm.) though the length from nose to tip of tail is but 8 inches (200 mm.). They are much used in climbing about the boughs on which they roost, and their tips are then folded in precisely the same manner as in the vespertilionid genus *Miniopterus* (see Fig. 24, p. 541), the second phalanges of the third and fourth digits being turned inward so as to lie flat on the lower surface of the wing. Perhaps *Eidolon* is thus better able to search about for fruit. *Hypsignathus* and the epaulet-bats, on the other hand, have more difficulty in approaching and detaching them; they are not active climbers, and can bend these joints but little inward, using the tips of the wings more often to cover the belly as they hang upside down (see Plate XLVII).

Among flocks of *Eidolon helvum* the immature members are always numerous, as could be ascertained by looking over the large numbers killed by natives at their roosts. In November at Avakubi, out of 12 females, the five really adult were gravid, four having one fœtus and the fifth two. This would indicate the existence of a definite breeding season, although the testes of an old male taken at Avakubi in May (No. 48706) were unusually well-developed, measuring 24 mm. in length. The fur of the front of its neck was moistened with a sticky fluid (not greasy) possessing a slight musky odor, apparently secreted by the skin beneath. At all seasons these bats have a disagreeable smell.

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<sup>1</sup> The notation of the species in this list is the same as that of Part I, the numbers prefixed to the names of the species in either list serving as a cross-reference to the same species in the other.

At Avakubi, November 19, 1909, a flock of perhaps 100 had taken shelter for the day beneath the limb of a large tree, some 60 feet above the ground, where they were shaded by a mass of epiphytic ferns and orchids, and formed one great squirming mass. Ever and again one seemed to lose its hold in the crowd, took wing, and hooked itself up anew. All the while they kept up a chorus of snarling and scolding noises that could be heard a hundred yards away. This led to their discovery.

After watching their amusing struggles for a while, we fired both barrels of a gun into their midst. We were standing almost directly beneath, and for a few seconds it simply rained bats, dead or wounded. The latter immediately began to make off through the grass, but were hunted down by the blacks, who picked them up with caution, for they scratched and bit savagely, often uttering a harsh nasal cry. Thirty-seven specimens were secured. Of the survivors, only about a dozen returned to the same branch, the others seeking refuge somewhere else, for all these fruit-bats fly well during daylight.

A flock passing over the Ile Berthe near Stanleyville on the evening of August 2, 1909, was estimated, as we watched them for a quarter of an hour, to number from 1000 to 1500. They flew in a westerly direction.

From August, 1913, to September, 1914, Chapin remained in the region about Avakubi and took a special interest in the seasonal vagrancies of these bats. He not only kept a very careful watch during his customary strolls but also collected many bats to verify his observations, of which the following is a summary.

Until early September (9th) none were noticed, but from that time on for about three weeks hundreds went flying over almost every evening, traveling in a southwesterly direction.

No more were observed until early in May, 1914, when many of them began to come flying across the Ituri River and over the post, from the northwest. Though they would pass at only 20 yards above the fruit trees that were being plundered just then by *Hypsignathus*, they evinced no interest in the guavas. During the rest of May and until about June 10, they passed regularly in large numbers in a southwesterly direction. After that they seemed to have established themselves in the region, for they were seen flapping about in more aimless fashion and alighting in trees. On June 5 a restless flock of 20 were found during the afternoon in a rubber tree. When approached they climbed about in their usual noisy and nervous manner, using the claws of both wings and feet, but finally took wing.

Though they were apparently resident at Avakubi in July, migratory flights towards the southeast took place again on the 2d and 4th. In August they had disappeared once more.



At Medje from May 10 to early June, 1914, Lang observed them flying every evening in an easterly to southeasterly direction, though in June the later arrivals gathered in the trees just before nightfall. Dozens of them were killed every day by the natives with arrows and nooses.

Certain small islands in the Aruwimi near Panga are famous in that region for the number of these bats that they harbor at certain seasons. We were told when passing in September that they always come at low water (February and March).

At Stanleyville a few were seen again in October, 1914, and great numbers at Sierra Leone in February, 1915.

At Leopoldville they are brought to market tied together in large bunches, dead and alive. We saw this in December, and in April Rodhain and Bequaert procured live individuals for their study of the dipterous parasites (Nycteribiidae), with which *Eidolon helvum* is habitually infested. The remarks of these authors on the habits of these bats in captivity<sup>1</sup> are worthy of repetition. "We have fed these animals almost wholly on sweet bananas, of which they consume considerable quantities, but which pass through the digestive tube with great rapidity. These bats seem hardly to assimilate anything but the directly soluble juices contained in fully ripened fruit, for the substance of the fruit itself is passed out by the anus practically unchanged."

During the two and a half years we were in the Upper Uele district, beyond the northeastern edge of the forest, we never observed *Eidolon helvum*, but found *Epomophorus anurus* common at Faradje, and *Epomops franqueti* was still heard in the forest galleries as far north as Yakuluku.

Schubotz found large colonies of *Eidolon helvum* in September on the islands of Lake Kivu, but there are no records apparently of its occurrence in British East Africa, though its range is usually given as extending across tropical Africa from Khartum on the north to Namaqualand in the south. This roussette is very gregarious and within its range the most abundant of its family, but its occurrence in large numbers is decidedly irregular. No observing traveller can fail to notice their immense flocks as they pass by the thousands just after sunset, especially in the neighborhood of open water. Their flight is then fairly rapid. In fact they can actually sail with rigid wings, descending at times slightly in their direct undulating progress, seldom making a low guttural sound. Those who have had an opportunity to see thousands of these bats defile every evening in the same direction high in the air have no doubt as to their performing a migration, especially since at first none of them seem to alight. Only later they sud-

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<sup>1</sup> Bull. Soc. Zool. de France, XL, 1916, p. 250.

denly appear to have made themselves at home. This becomes apparent at once, since hundreds of them are then slain by the natives, who are fond of eating these bats.

We are not able to coördinate our present observations and the published records from various regions so as to show beyond a doubt that large migrations take place at definite seasons. Such movements might be necessary to find new fields of food supply, though throughout the equatorial forests fruits seem to be available during the whole year. Unfortunately we could not ascertain what fruits they really prefer, as the stomachs of dead specimens were always found to be empty. The reason for this is explained by the experiments of Rodhain and Bequaert. It is nevertheless certain that immense numbers of *Eidolon helvum* journey about irregularly and then become abundant in regions from which they were previously absent.

## 2. *Epomops franqueti franqueti* (Tomes).

Plate XLIV, Fig. 2; Plate XLV.

This is a typical epaulet-bat; the adult males have a peculiar glandular sac lined with long white or yellowish hair on each shoulder, always very conspicuous in dried specimens. But in the live bat this pocket may be so drawn in as to conceal the "epaulet" almost completely. Its dull brown pelage is often tinged with purplish, especially on its darker ventral side, which bears a conspicuous whitish patch on the abdomen. They have no tail. The thin lips are muscular and distensible, well adapted for sucking fruit.

The adult males are somewhat larger than the females and reach 7 inches (178 m.) in length with a wing-spread of 23.62 inches (600 mm.). They appear to give birth to but one young which, in one case, though two-thirds the size of its mother, was still clinging to her breast and was carried about during flight. The breeding season probably extends throughout the year since we have recorded young during every month in which we collected these bats — from October to May.

No traveller visiting the Congo forests can fail to hear the peculiar note of *Epomops franqueti franqueti*. The loud roar of the tree-hyrax (*Dendrohyrax*) and the short, tirelessly reiterated whistle of this bat are by far the most typical nocturnal sounds. Throughout the year in the neighborhood of almost every village in the Ituri region, and far beyond the forest area, wherever there are propitious wooded places, its vocal efforts ring intermittently through the stillness of the night — practically from sunset to sunrise.

Strange to say, experience taught us that very few Europeans knew that they were listening to a bat, since this high-pitched musical sound with its continuous effort seems to be emitted rather by a bird than a mammal. Standing on the deck of a steamer that had tied up for the night at one of the islands in midstream below Bumba, we heard them for the first time, and for our part were greatly perplexed. Finally we felt content to ascribe these strange sounds to some night bird, especially as the natives and white men of long experience in the Congo confirmed our belief. Questioning the natives is to little purpose, for they consider bats to be birds, and will simply reply that it is a bird of the night and eats fruit.

The voice of *Epomops franqueti franqueti* is more nasal than that of *Hypsignathus* and when heard at short range might be written *kŭrnk!* or *kyŕnk!*, but at a distance it has a whistled effect, almost musical, being repeated slowly with intervals of  $\frac{3}{4}$  to 1 second, and often for many minutes without a break. Only the adult males, as in *Hypsignathus*, have a large ossified larynx and they alone produce this weird, curious call. Though several of them may be heard simultaneously, these bats are hardly gregarious and when calling are usually far apart. They are very shy, and become silent at once when approached. More often they fly off quietly, recommencing their solo at some distance.

During the daytime when frightened from their retreats in the dense undergrowth of the forest, only one or two are usually seen at a time. This fruit-bat often visited the post at Avakubi to steal guavas, frequently carrying them, before eating, to a more suitable perch, sometimes into mangotrees or even out to an island in the Ituri River, about 200 yards away. Traces of their meal — parts of the seed-filled pulp, or half-eaten fruits — could often be seen in such places lying about the ground. Wild figs were likewise eaten but the presence of these bats near villages has probably much to do with their liking for ripe bananas, which they often find in neglected gardens. Undoubtedly they are keen of scent, for they come without fail to bunches of mellow bananas fastened beneath an overhanging roof where they could not possibly be discovered by sight. The peculiar strong fragrance of this fruit offers the only explanation of their success in this respect. At Avakubi, Medje, and Niapu they regularly fed on our bananas, pulling down many more than they ate. In a native village near Niapu several of them came together. One night a female was caught by the wing in a rat-trap set purposely. She made a hoarse snarling noise, flapping about desperately; but the others, so wary otherwise, did not mind this in the least and kept on feeding. Two of them were taken in lighted rooms, evidently attracted by the ripened fruit in the house.

We have observed this species everywhere in the Ituri district, as far



east as Penge, and also at Niapu and Poko in the Uele. They were still common at Niangara and Vankerekhovenville, and one specimen was taken in the lower Congo at Leopoldville. We have heard them along the rivers wherever suitable forest is abundant, as far northward as Aba, Yakuluku and near Bafuka. They range from southern Nigeria and Angola eastward to Lake Victoria.

### 3. *Hypsignathus monstrosus* H. Allen.

Plate XLIV, Fig. 4; Text Figs. 2 (p. 419), (p. 485), 18, 19, 20.

The hammer-headed bat with its strangely truncate head is much better pictured by its scientific name, which refers to the enormously swollen nasal region of old males, the monstrously developed pendulous lips, the grotesque ruffles around the nose, the warty snout, and the hairless split chin (Text Fig. 2).

In adult males, which are much larger than the females, the cheek-pouches are extraordinarily developed, extending beneath the entire face anterior to the eyes. All this skin, as well as the upper lips, hangs loose. Only about the nostrils is it firmly attached, but the pouches of the two sides are completely separated by a thin, elastic median partition along the broad ridge of the rostrum, where the skin is much thickened and provided with numerous fibers of striated muscle. Beneath it two tube-like prolongations of the cheek-pouches run back close along the mid-line to between the ears, where the short hair on the top of the face ends. The lower lips are only attached to the inferior border of the rami and are free as far back as the last molar. In the region of the symphysis their muscular attachment is especially peculiar (Text Fig. 18).

In general color *H. monstrosus* is nearly uniform grayish-brown, with a slightly paler abdominal patch, a lighter grayish band across the breast, and a white tuft of hair near the base of the ear. This is by far the largest fruit-bat found in Africa, with a wing-spread of 3 feet 2 inches (967 mm.) and a total length of 10.25 inches (260 mm.). They bear only one young, as shown by dissections of several females, each of which had a single foetus, in May and December. We therefore assume that they reproduce throughout the year.

When hanging at rest they fold their wings so as to form a rain-proof cover over the breast and belly. During the day we observed them, either singly or in small groups, in the denser foliage high up in the trees, or even in the undergrowth. Near the bank of the Nepoko River at Bafwabaka, in May, 15 of them were discovered some 60 feet from the ground, so close

together that 6 were brought down by a single discharge of the gun, only one of them an adult male. On the other hand, near Avakubi, a lone bat was disturbed during the day in the undergrowth, and flapped out close beside us.

Throughout February and March, 1914, a number of these huge noisy bats used to gather in the trees along the forested bank of the Ituri River a couple of miles above Avakubi, where we camped and observed their habits closely. Every evening, shortly after sunset — about 6.15, to be exact — some 30 of them would be seen crossing the stream to the south bank, not in a flock but singly, in straggling fashion. Entering the trees

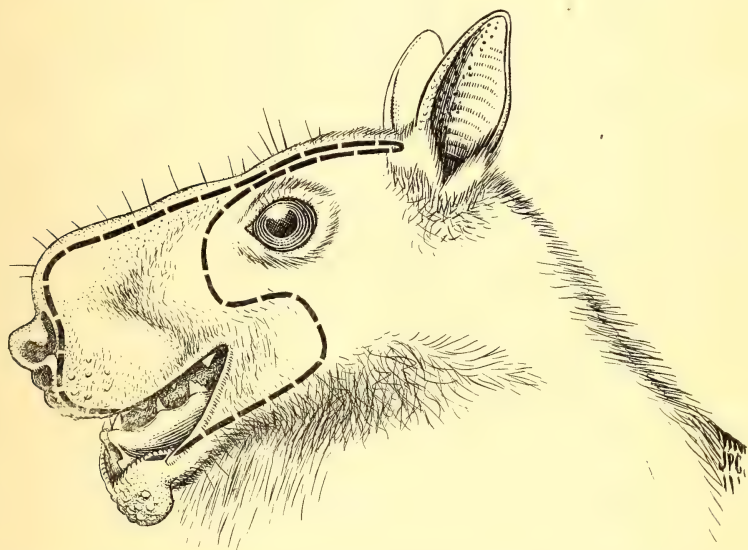


Fig. 18. *Hypsignathus monstrosus*. Head of adult male (No. 48657). The heavy broken line indicates extent of cheek-pouch.  $\frac{3}{4}$ .

on the far shore, they would start at once to call. Each individual gave a loud *pwök!* or *kwök!*, repeated at short intervals, say of  $\frac{1}{3}$  to  $\frac{1}{2}$  of a second, though occasionally several notes would be emitted in very rapid succession.

This noise would continue without serious interruption till 10 or 11 o'clock, to be taken up again at intervals later on, but ceasing entirely by half an hour before daylight. We never saw them recross the river.

During this performance their utter lack of fear was amazing. Neither talking, rapping on the trees, lighting a lantern, nor even firing a gun could induce them to cease their calling. Their chorus made us think of a pondful of noisy American wood-frogs, greatly magnified and transported to the tree-tops.

At this particular spot only adult males assembled, as was shown by the nine specimens shot as they crossed the river; before darkness set in they had all arrived. Yet they did not seem to come in search of food. Large rat-traps baited with guavas were fastened in the trees they visited, but none was touched.

Just before they began to cross the stream, every evening, we could hear the whole chorus far back in the forest, where they evidently spent the day with their females and young. An overcast sky would delay their arrival 10 or 15 minutes, and rain would practically silence them. Although wounded females have been heard to produce a harsh noise, the old males alone call in this loud fashion. Their enormous ossified larynx is responsible for their very loud voice. The males of *Epomops franqueti*, which likewise call strenuously, also show an enlargement of this organ, whereas the females of both species have it more moderately developed. In *Epomophorus anurus* and *Eidolon helvum*, on the other hand, species which are comparatively silent, the larynx is of normal size.

We observed the hammer-headed bat in the northeastern part of the Congo forest throughout the year, and we are sure it does not migrate; yet there is no doubt that the ripening of certain fruits, wild and cultivated, influence its local occurrence.

At the post of Avakubi throughout the following May and early June (1914), many hammer-headed bats were to be seen flying about every evening, making their appearance about a quarter of an hour after sundown. They turned their attention at once to the guava trees, fluttering and hovering in search of fruit. They were awkward at plucking the guavas, which are undoubtedly taken in the mouth, for one of them killed by a rat-trap was still clasping the fruit in its teeth. Next the fruit was carried off to some convenient perch — usually bare of foliage, often in a mango tree — perhaps 100 yards away, where they proceeded to cut it up with the teeth, letting drop a great deal of the pulp and probably swallowing simply the softest parts, perhaps only the juice. The elliptical rasp-like patch on the upper surface of the long tongue helps in these operations (Text Fig. 16, p. 485).

So numerous were the bats at this time that spots covered with guava pulp and half-eaten guavas were to be seen on the ground all about the station. Mangos, too, were now ripening, but they were only occasionally consumed. Other fruits known to be devoured by this bat are wild figs, sour sop, and bananas.

Contrary to what we had observed up the river, these bats were mostly immature; but there were a few adult males among them whose voices were sometimes heard. During the day stragglers were found hanging in shady mango trees about the station, but the majority went somewhere else to roost. By the end of June their visits had ceased.



*Hypsignathus monstrosus* was also heard and seen by us as far up the Ituri as Penge, and on the River Epulu, while at Stanleyville from August to December this call was not infrequently noted, but that of *Epomops franqueti* was the more usual. The species ranges, however, from Lake Victoria (Andersen), through the upper Ituri, northward to Niangara (in the Uele), and westward across the forested portions of the Congo basin and the Kamerun (Bates & Sjöstedt), along the Gulf of Guinea to the Gambia (Büttikofer). It shows a great liking for the neighborhood of water.

The pharynx, larynx, and hyoid bones of various species of *Epomophorus* and *Epomops*, as well as of *Hypsignathus monstrosus*, were carefully studied by Dobson.<sup>1</sup> The last-named species, however, he dismissed with a few words: "There are no posterior air-sacs; but the anterior sacs are well developed, and separated internally below, not by a thin partition as in the above-named species [*i. e.*, of *Epomops*], but by an intermediate sac communicating with the pharynx by an aperture between the mylo-hyoid tendons." Matschie, in 1899,<sup>2</sup> remarked briefly upon the enormous size of the larynx in the male of *Hypsignathus*, and gave a figure illustrating it.

The results of our two dissections are embodied in figures 19 and 20, where the proportions and structure of the larynx, as well as the arrangement of the remaining viscera, are clearly shown. The soft palate is greatly prolonged and divides the pharynx into two separate parts, a large thin-walled nasopharynx and a narrow, thick-walled oropharynx. The lumen of the oropharynx, like that of the esophagus, is so small as to indicate that only the juices of fruits are swallowed.

Into the sides of the nasopharynx open the pair of air-sacs, which lie in front of the sterno-mastoid muscles and just below the parotid glands. We were unable to find, in either of our specimens, the second pair of sacs mentioned by Matschie as lying near the shoulder; and there is no median ventral sac as described by Dobson. A tearing of the muscles of the throat in one specimen, due to the stretching of its neck after preservation in alcohol, at first deceived us, but the cavity we mistook for an air-sac proved to be simply a rent in the areolar tissue of the neck.

The two lateral sacs, according to Prof. H. v. W. Schulte, are perhaps to be looked upon, morphologically, as hypertrophied developments of entodermal pharyngeal pouches — probably the third or fourth pair — and equivalent to the occasional internal branchiogenetic sacs of the human embryo.

In no other mammal is everything so entirely subordinated to the organs

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<sup>1</sup> Proc. Zool. Soc. London, 1881, pp. 685-693.

<sup>2</sup> Sitzber. Gesell. Naturfor. Fr. Berlin, 1899, p. 28.

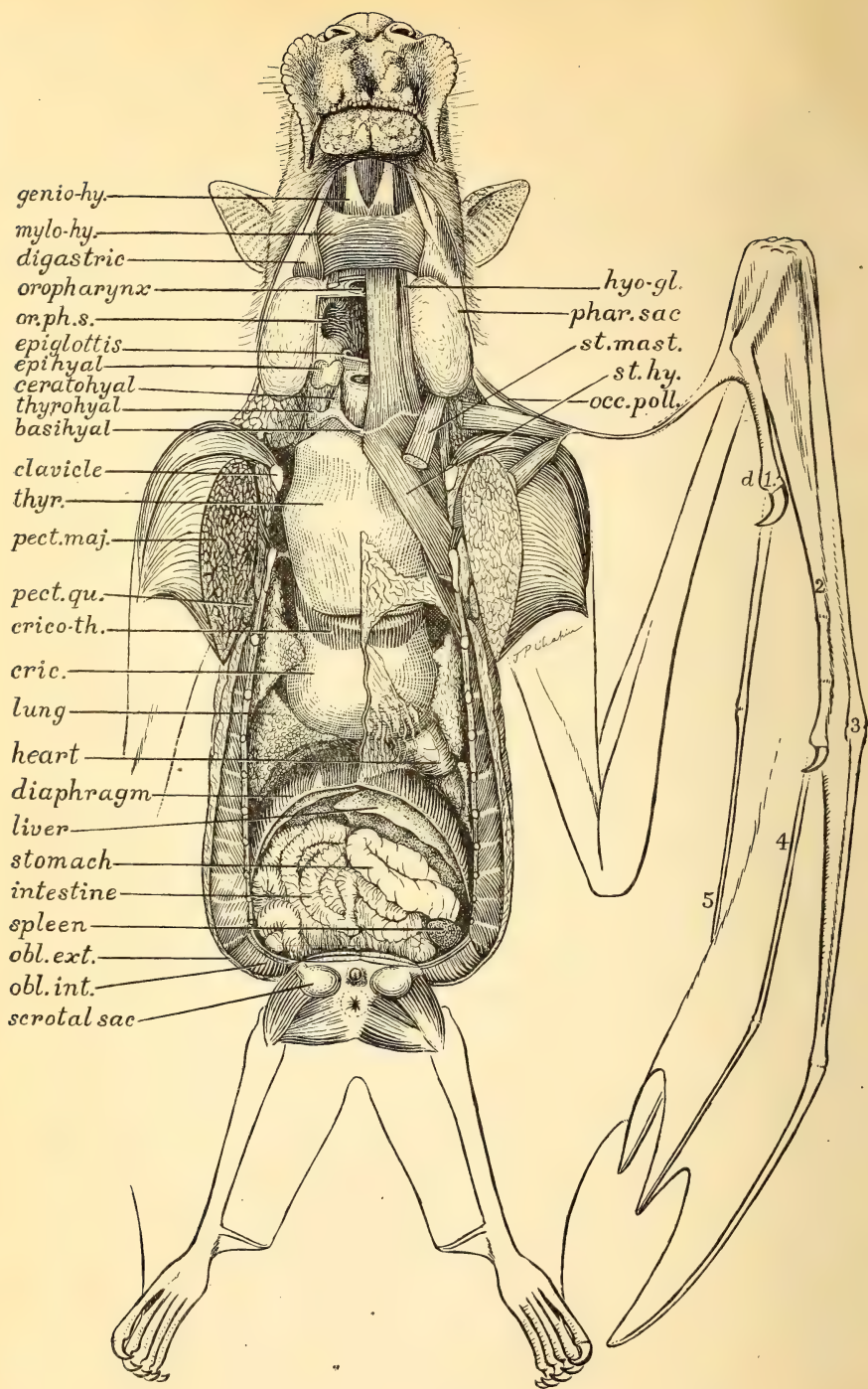


Fig. 19. *Hypsignathus monstrosus*. Adult male (No. 48657). Dissection from ventral side, showing pharyngeal sacs, hyoid bones, larynx, and general arrangement of viscera. *cric.*, cricoid cartilage of the larynx; *crico-th.*, crico-thyroid muscle; *d. 1, 2, 3, 4, 5*, first to fifth digits; *genio-hy.*, genio-hyoid muscle; *hyo-gl.*, hyo-glossus muscle; *mylo-hy.*, mylo-hyoid muscle; *obl. ext.*, external oblique muscle of the abdomen; *obl. int.*, internal oblique muscle; *occ. poll.*, occipito-policalis muscle; *or. ph. s.*, orifice of pharyngeal sac communicating with nasopharynx; *pect. maj.*, pectoralis major; *pect. qu.*, pectoralis quartus; *phar. sac.*, left pharyngeal sac; *st. hy.*, sterno-hyoid muscle; *st. mast.*, sterno-mastoid muscle; *thyr.*, thyroid cartilage of larynx.  $\frac{2}{3}$ .

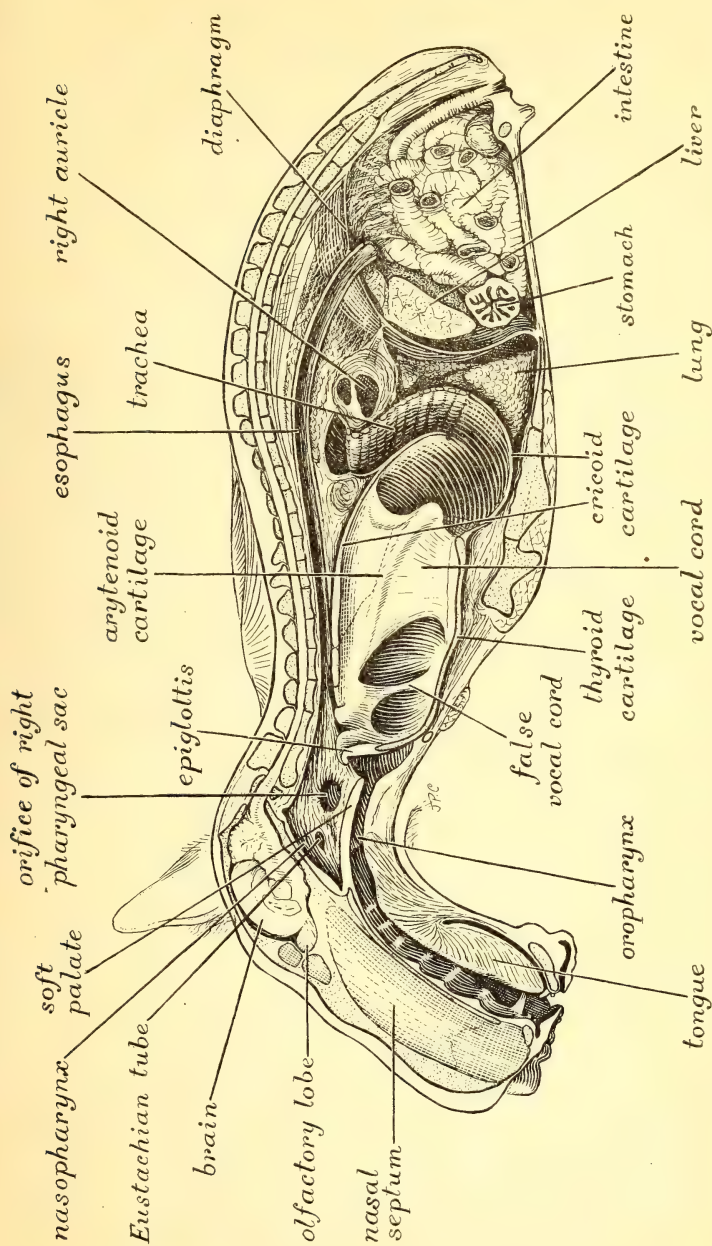


Fig. 20. *Hypsignathus monstrosus*. Sagittal section of adult male (No. 48655), showing pharynx, vocal organs, and viscera.



of voice. In the howling monkey (*Alouatta*), famous for its far-sounding cries, the hyoid is transformed into a resonating apparatus, but in the males of *Hysignathus monstrosus* the importance of the vocal efforts consists not so much in the strength of their noise as in the continuity of their production. We find instead of a fixed ossified reverberating organ, as in *Alouatta*, a pair of air-sacs inflated at will and a tremendous enlargement of the larynx and vocal cords. The sound produced can hardly have any other purpose than to attract the females.

The drawings (Figs. 19 and 20), make it perfectly plain that the larynx, as Matschie says, "is nearly equal in length to one half of the vertebral column," and actually fills the greater part of the thoracic cavity, crowding the heart and lungs back and sideways until the posterior end of the cricoid cartilage is practically in contact with the diaphragm. The trachea is wide, but folded upward on the posterior surface of the larynx. This extreme development of the larynx is simply the result of the enlargement of its usual elements, especially the thyroid, arytenoid, and cricoid cartilages, which have undergone extensive ossification. The vocal cords are extremely broad, and it is our belief that all these modifications have to do mainly with the voice, although Dobson held that the arrangement of the pharynx, hyoids, and their muscles was admirably suited for sucking out the soft interior of fruits.

The whole abdominal cavity is relatively restricted in size. As might be expected from the nature of the food, which consists of fruit-juices, the stomach is rather small, bent upon itself, with its inner lining deeply folded, while the intestine is slender and much convoluted. In both these specimens the alimentary tract was empty.

#### 4. *Ephomophorus anurus* Heuglin.

Plate XLIV, Fig. 1, and Plates XLVI and XLVII.

Beyond the northern edge of the forest, the common representative of the family is this medium-sized fruit-bat, with a rudimentary tail, never more than one-third of an inch (6 mm.) in length, right below the inter-femoral membrane. The uniform brown color of the back looks more or less faded in the different individuals, and they are still paler on the ventral side, an ill-defined whitish abdominal patch being especially apparent in adult males. These, of course, are easily distinguished from the females by the curious white epaulets and sometimes show a darker band across the breast. An adult male measures 5.75 inches (145 mm.) in length and

has a wing-spread of about 21 inches (530 mm.); the females are slightly smaller.

Young in different stages taken during November and January would indicate that they have no definite breeding season, especially as in November a female was found having one embryo.

The larynx of this bat is of normal dimensions, and its note can be heard only a short distance. A captured female when annoyed gave a short whistle, and a chirping sound was often heard by Chapin while waiting at dusk for birds in swampy, wooded places near Faradje. It was repeated with great regularity for some time but would hardly have been ascribed to a bat if we had not had the opportunity of hearing it often. As already stated this was the only fruit-bat common in the region about Faradje, and during daytime was occasionally frightened from its roosts in leafy trees near rivers or swamps. Sometimes they gathered in flocks of 30 or 40 but hung singly or scattered amid the branches of a grove of trees. Securely hooking their sharp claws over a twig, these fruit-bats hang head downward by their straightened legs. Wrapped between the soft folds of their dark wings there is little to be seen of the khaki-colored lump of fur. In fact they often disappear completely between the indistinct blotches of the manifold shadows from the surrounding boughs. If approached during daytime the finely chiseled snout first emerges from its restful pose and the twitching ears and twinkling eyes quickly gather the information that will induce them to take wing (see Plate XLVII). Quite often they were hiding in the dense foliage of rubber-trees (*Manihot*) but if one was shot all the others would fly off some distance to other trees, in spite of the furnace heat and glare of the sun. On two occasions they came into lighted rooms, perhaps in search of bananas hung on the veranda.

We observed *Epomophorus anurus* only near Faradje, but its range extends from the northeastern Uele district into the Bahr-el-Ghazal eastward to Erythrea, across Abyssinia and southward to the Tanganyika.

##### 5. *Epomophorus wahlbergi haldemani* (Hallowell).

This bat is rather similar in appearance to *Epomops franqueti franqueti* but is smaller and without the light abdominal patch. An adult male measured 5.75 inches (145 mm.) in length and had a wing-spread of about 20.5 inches (520 mm.). Its shoulder-pouches were well developed, but drawn in so that the rather short white hair did not show. The edges of the sacs were moist, but they had practically no odor.

In some of the groves of cocoanut palms on the beach at Cape Lopez these epaulet bats were not shy but hung from the midribs of the leaves in

plain view, half a dozen in a group and sometimes 40 to 50 in a grove. The larynx was rather small, and during the several days our ship lay in this harbor we never heard any noise that could be attributed to these bats.

The range of this species extends from the Kamerun to Angola on the West Coast and across to the East Coast between Zanzibar and 2° north.

#### 6. *Micropteropus pusillus* (Peters).

The first sight of this pigmy among fruit-bats is sure to cause considerable surprise. Indeed, measuring only 2.75 inches (70 mm.) in length, with a wing expanse of only 11 inches (279 mm.), it may be compared with a medium-sized insectivorous bat, such as the common American red bat (*Lasiurus borealis*), though of course the latter has a long tail, whereas *Micropteropus* is tailless. Its color is medium brown above but very light below. The white tufts at the base of the ear are distinct, and the adult males have epaulets of the same color.

Though there is one record from the Gaboon, our long experience in the forest, where we never came across this species, leads us to suppose that it occurs only outside in more open country. This is also in accordance with numerous other observations. Its range then extends on the West Coast from Gambia in open places southward to St. Paul de Loanda and probably all along the northern border of the West African rain-forest as far east at least as the Bahr-el-Ghazal, the Uele district, the Semliki River and even to the east shore of Lake Victoria. Our specimen was taken near Niangara.

These and the two following small forms of fruit-bats are probably never as gregarious as their larger relatives nor do they live together in colonies like some of the insectivorous bats. The few we saw were hanging singly or by twos between the leaves of dense bushes, never very high from the ground. Experience shows that they have a much wider range than is generally believed. They have merely escaped the attention of naturalists, who have but scant chances of stirring up these hermits among the fruit bats. Conscious of the perfect protection these small bats are offered everywhere in dense clusters of leaves they are not wary and seldom flutter out of their hiding places.

We believed at first that they did not feed on cultivated fruits, such as plantains or bananas, and therefore would be much rarer in the neighborhood of villages, where we were most successful in getting acquainted with numbers of the larger species. Later we concluded that they might be found everywhere in suitable places, in the middle of the forest as well as in a bush close to a native hut, but we collected them only in the places where we camped for longer periods.



### 7. *Casinycteris argynnis* (Thomas).

Only a single specimen of this rare fruit-bat was previously known from the Kamerun and our record from Medje in the Ituri shifts the limit of its range at once 900 miles eastward. Its queer dentition and other structural characters make it a bat of great interest and any positive clue as to its food and habits would be an important contribution.

*Casinycteris argynnis* is a rather small, practically tailless fruit-bat of about 3.5 inches (92 mm.) in length. The fine hair on the upper side has the peculiarity of being dark brown at the base, lighter in the center and brown again at the tip. The crown and nape are somewhat lighter. The grayish-white sides of the neck and throat fuse with a patch of the same color that runs down the short-haired abdomen between the gray-brown sides. A white spot behind the nose, where the hair starts to become longer, and one at the posterior corner of the eyes, and a white border on the upper lips are also characteristic of this bat. It is further distinguished by the fact that the wing membrane joins with the phalanges of the first and not with those of the second toe as in all the other fruit-bats we collected, except *Eidolon helvum*.

In the fresh specimens the rather flat nose is a dirty pink, but the skin visible underneath the hair is pale yellowish. The ears have only faint white tufts at their base and are, like the wing membranes, yellowish brown; the phalangeal joints however are much lighter. The eyelids are straw-colored but the round pupil was so large that we almost overlooked the yellowish-brown iris.

Its queer premolars and molars, the enormous spreading of the zygomatic arches that goes hand in hand with a strong and broadened ascending ramus would indicate a crushing rather than a cutting dentition. These characters, together with the short bony palate and the curiously developed palatal ridges, seem indicative of a diet very different from that of ordinary fruit-bats, especially as the shortness of its tooth-row also suggests features typical of insectivorous bats. Unfortunately its stomach was empty, though we found one foetus (April) in dissecting.

This bat was hanging alone in the dense foliage of a bush only ten feet from the ground at the edge of a native village near Medje, and was the only specimen we saw.

### 8. *Myonycteris wroughtoni* Andersen.

An inconspicuous and very small fruit-bat, it attains only 5 inches (130 mm.) in length, of which the tail absorbs half an inch. The four specimens

secured are all from Medje, and they prove that this species varies considerably as to color. The dark brown on the upper side may become considerably lighter and take on even a reddish or yellowish-brown appearance. That this is merely individual variation is shown by a female with a reddish-brown back that was hanging in a bush (in September) together with her half-grown young, also a female. The latter has a dark-brown back and crown like another adult female, but is much darker than its mother. On the short-haired ventral side the difference between the four specimens is not so apparent. In the fresh adult specimens the iris is dark brown, as are also the nose, ears, interfemoral and wing membranes; the latter show on the under side a dark bluish-gray bloom from which the whitish digits stand out conspicuously.

The fine adult male, which was fortunately added in April, 1914, had a broad patch of coarse tawny orange-yellow and gray hairs reaching from the sides of the neck over the shoulders, across the breast, and as far forward as the throat. This peculiar wavy hair was rather unctuous, as a result no doubt of the excretion from the glandular patch of skin beneath. These hairs grow in bundles of ten or more together, whereby a ruffled effect is produced. The females have no specially colored patch on the breast, but show the usual gray or yellowish-brown hair, which however is somewhat longer and slightly kinky. A comparison with the males of *Eidolon helvum* suggests itself, as they have also a patch of coarse, rather shorter, tawny-yellow hair growing over glandular skin like the males of *Myonycteris wroughtoni*, but in *Eidolon* the tawny-yellow hair does not extend as far forward and grows in the ordinary manner, not in bunches. The females too of this species have a patch of yellowish hair but much longer, fine, and silky.

In many fruit-bats, *Eidolon*, *Epomophorus*, *Pteropus*, *Myonycteris*, and many others, the patches of coarse hair on the breast, at the base of the wing or on the mantle are distinctive features of the adult males. In the epomophorine bats the epaulet is peculiar, being a pocket lined with white or yellow hair which is also coarse. Connected with such patches is always a cutaneous glandular formation. The hairs at least at certain periods are moist or unctuous, sometimes slightly odorous.

*Myonycteris wroughtoni* was previously known only from the Likati River, 240 miles west of Medje, where it had been collected by the Alexander-Gosling Expedition in 1906.

## MICROCHIROPTERA.

## EMBALLONURIDÆ.

9. *Taphozous mauritianus* Geoffroy.

## Plate XLVIII, Fig. 1.

The pointed short-haired muzzle, the large eyes, the erect ears, the light-grayish, peculiarly freckled tints above, and the pure white below give to this tomb-bat its clean appearance, which is further enhanced by the glistening effect of the smoothly appressed hair. The wing membranes are white, nearly translucent, and appear quite conspicuous when they fly during daylight. The glandular pouch under the chin is not so well marked in the females as in the slightly smaller males.

They have only one young and breed probably throughout the year, as proved by several half-grown young collected in April, May, November, and December and also by records of an embryo in May and of a young one still clinging to its mother's breast in April.

In Faradje where they were the commonest bat and had established themselves in all the houses, they did not care in the least for dark places in the interior of buildings, nor did they hang from the rafters as do *Hipposideros caffer centralis* and *Nycteris hispida*, but preferred to cling along the outer side of the brick walls right below the thatched roof. Here they could be easily observed, and it was apparent that their folded wings were of as much assistance to them as their feet while clambering along the bricks. Sometimes as many as a dozen were seen along these walls, though each one kept by itself. If one walked immediately below them they would shift nervously sidewise or climb on top of the brick walls, only to return when the disturbance had ceased. Rarely would they fly out into the sun to hide in some shady place in a tree or other building.

They appeared later than other bats, in fact only when complete darkness had set in, so that it was impossible to shoot them in flight. They seldom entered lighted rooms. As they flew out from beneath the roof or made sudden turns a peculiar whirring sound could be heard, probably caused by a skin-fold that runs from the radius to the base of the fifth digit and is characteristic of the genus *Taphozous*. Their well-developed wing muscles indicate the rapidity and great power of their flight. According to stomach contents their prey consists chiefly of small moths, undoubtedly



captured on the wing, and we have no evidence whatsoever to support Mr. E. C. Buxton's statement that one species of *Taphozous* (*T. affinis*) is a fruit-eater,<sup>1</sup> nor have we found any African microchiropterous bat feeding on vegetable matter.

During flight when following each other in rapid turns or when moving about on the brick walls, they often fight together and make a screeching sound.

We found them very numerous in the bushveldt region north of the forest, especially at Niangara, Faradje, and Yakuluku. There were none at Medje, which is situated in the forest. Around Avakubi large clearings are numerous and though situated in the midst of the Ituri forest the houses of this post sheltered a few of these bats throughout the year. *Nycteris* and *Hipposideros*, however, were the common bats. We believe therefore that *Taphozous mauritanus* is typical of the bushveldt country and practically absent from the dense tropical rain-forest.

The range includes Tropical and Southern Africa, Madagascar, and the Mascarene Islands.

#### 10. *Taphozous sudani*, Thomas.

This recently described "tomb-bat" has a uniform dark-brown color with only slightly paler under side. Its total length of 4.25 inches (111 mm.) and wing-spread of 15.75 inches (400 mm.) show it to be a bat of somewhat smaller size than *T. mauritanus*. The greater portion of the wing membranes are likewise white and translucent, and there is a naked triangular patch on the forehead in the small depression between the anterior edges of the ears, but the gular pouch is absent.

About 150 to 200 bats of this species were found in a large fissure in the steep side of a rocky hill a few miles west of Dungu. They were clinging to or crawling along the surface of the rock and by their behavior reminded one strongly of *T. mauritanus*. They preferred however to stay within the shelter of the darker places, and took wing when disturbed, though they made no vocal noises. They never crawled over each other, but sometimes would sit so close as to form great dark patches against the rock. The contents of the stomach show that they feed exclusively on insects.

The range of this species, formerly recorded from Mongalla on the White Nile, is extended over 300 miles to the southwest by these specimens collected in the northeastern Uele district.

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<sup>1</sup> Dobson, Catalogue of Chiroptera, 1878, p. 390.

11. **Saccolaimus peli** (*Temminck*).

## Plate XLIX.

The uniformly blackish or dark-brown color and large size distinguish it at once from all its other African relatives. The somewhat larger females attain a maximum length of 6.12 inches (157 mm.) and a wing-spread of 27 inches (685 mm.). Thus *Saccolaimus peli* has the distinction of being the largest insectivorous bat of the African continent and is approached only by *Hipposideros gigas*. A semi-circular frill forming the border of a

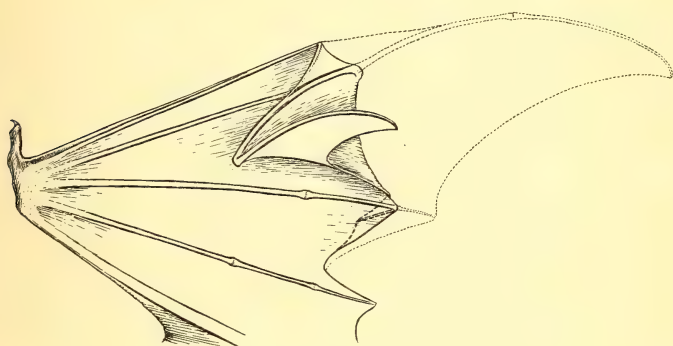


Fig. 21. *Saccolaimus peli*. Wing from above (No. 49350), to show folding of the tip (wing with tip extended shown by dotted line).  $\frac{1}{2}$ .

peculiar horseshoe-like shallow glandular pouch under the split chin is also an external characteristic, well marked in both sexes.

When at rest the tips of the wings are folded back on their upper surface in a very curious manner (Fig. 21). The third and longest digit has only two phalanges, of which the proximal one is turned upward but the terminal one backward again. With the wings thus shortened to nearly half their whole length they can, as we have seen in live specimens, climb about more easily in the rough interior of hollow trees when seeking for a propitious place to rest. When wounded and brought to the ground they bite savagely and in trying to escape use their folded wings to great advantage, since with their aid they scurry over the ground much more rapidly than other bats.

The short free tail, as in all Emballonuridæ, is loosely enclosed at its base in the wrinkled interfemoral membrane. Thus in flight, by stretching their hind-limbs, this membrane slipping quite easily over the tail-vertebræ, can be considerably lengthened. So by pulling in or moving out their legs,

these bats can set their sail, as one might say. This arrangement would help to explain the extraordinary skill of these fast fliers in steering about.

Out of ten females, three taken in June and December, each had a single foetus. Therefore we may state that they have one young and breed at different seasons.

Throughout the year, shortly after nightfall, but especially on moonlight nights, a dozen or more of these skillful flyers may be observed sailing swiftly over the open village places. Usually they travel at a height of some 30 feet or more but very often when diving after their prey they come down in such elegant and rapid swoops as to resemble more a hawk than a bat. One can then distinctly hear the reiterated short chirping or squeaking notes uttered during flight. In foggy weather they fly very low, since the insects upon which they feed are evidently forced by the dampness to keep close to the ground. During the daytime they retreat into hollow trees where they cling to the walls singly, not forming clusters as the bulldog or molossine bats habitually do. Though their feeding grounds are chiefly the open places about human settlements we never found them in houses like *Taphozous mauritanus*. We often wondered why they disappear again so soon, but a specimen shot only half an hour after their arrival in the village clearing had its stomach already gorged with the well-chewed remains of tiny insects.

They may be considered typical of the region of equatorial rain-forests, as they seem to be absent from the bushveldt to the north of Niangara, although in the latter place they are still common. The large forest galleries along the Uele and its affluents evidently still furnish a suitable environment.

The range of this bat extends all across Tropical Africa from the Gold Coast and Kamerun to East Africa, though for the latter record the exact locality is not known.

## 12. *Colœura gallarum nilosa* Thomas.

Externally this bat is a small copy of *Taphozous sudani*, with the hair sooty-brown, becoming whitish at the bases. The thumb however is relatively longer, and the tail slightly shorter, though it protrudes above the interfemoral membrane. The gular sac is but slightly developed. The tip of the wing folds back exactly as it does in *Taphozous* and *Saccolaimus*; moreover the joint that thus becomes virtually the tip of the folded wing is protected by a pad-like thickening of the skin, no doubt preventing injury from the rough rocky walls of its home. Expanse of wings 11.5 inches (290 mm.), total length 3 inches (77 mm.), tail .62 of an inch (16 mm.).

The region of Aba, whence all our specimens come, is on the divide between the Congo and Nile basins; but this is not to be pictured as an



abrupt mountain chain. Quite the contrary, for it is only a rolling bush country, some 2800 feet above sea level, studded however with great numbers of rugged granite hills rising from 300 to 500 feet higher. As one follows the road from Aba to Yei, the point at which one leaves the Belgian Congo and enters the Lado would be scarcely noticeable were it not marked to the left by one of these hills known as the Libugu, literally "the rock," a well-chosen name for this great gray monolith, exceptionally bare and some 200 feet high.

Just as these hills are inhabited by a number of birds not found in the more level country to the southwest, so too they have certain peculiar mammals, notably hyraxes; and their fissures and grottos harbor, as one might well guess, numbers of bats. Extensive caverns we never saw; in igneous rocks one would not expect them; but in our climbs about these heights and cliffs we often set dark forms fluttering in the recesses, where however they were difficult to secure with the gun. The natives were naturally far better acquainted with the neighborhood and long practised in the art of bat-catching. We were aided particularly by the people of chief Ibu, a Logo; they knew the caves well, and when colonies of bats had been located they were smoked and stifled or beaten down as they tried to escape through the smaller openings. Near Aba eight species of Chiroptera were taken thus in the hills, several others being collected in other refuges, such as houses and banana plants. Here, as with the bats inhabiting hollow trees, it was found that colonies of the more abundant kinds were composed mainly of a single species, although some of the rarer ones (*e. g.*, *Rhinolophus axillaris*) may mingle with their commoner fellows.

The close resemblance of *Colœura gallarum nilosa* to *Taphozous sudani* is not restricted to external appearance, for both bats have the same habits and frequent similar sites. At Aba the smaller species lives in the caves, clambering about on their weathered gray walls, where its coloration is decidedly protective. Here it is very likely near the southwestern border of its range, for the species inhabits Northeast Africa; and this race, distinguished by the light bases of its hair, was described from the Nile region.

#### NYCTERIDÆ.

#### 13. *Nycteris hispida* (Schreber).

All the members of this genus found in the Congo are clothed in long soft fur of a brown or gray-brown color. They are very easily recognized on account of their large ears, minute eyes, the deep frontal groove hidden by the nose-leaves, and the long tail, which composes about one half of the

total length. Its tip is curiously bifid, Y-shaped, serving as a support for the edge of the interfemoral membrane. Both wing and tail membranes are traversed by numerous fine lines; on the inner part of the wing these intersect at right angles, and have little dark spots — sensory organs no doubt — at their crossings.

Externally the various species differ but slightly in color and size, and in the length of the ears. Of the species enumerated in the present paper, *Nycteris arge* and *N. awakubia* have the longest ears, *N. pallida* the shortest.

*Nycteris hispida*, whose ears exceed only slightly those of the last-named species, is very common in the forested region of the Ituri and about Stanleyville. There it is one of the bats most often seen flying about the villages, and one of those to enter most frequently lighted rooms at night. The pursuit of small insects drawn to the lamp is then its real aim. Along with it may come *Nycteris arge* and *Hipposideros caffer centralis*. Sometimes we would close all the windows and try to catch them with butterfly nets — a warm but exhilarating sport. Now thoroughly frightened, they flew round and round the room, close to the ceiling, dodging our strokes with incredible agility, and hanging up from time to time in distant corners. Or down they fluttered repeatedly to the doors or windows by which they had entered, seeking a way out. Seldom could we net them until they were completely tired out, and not infrequently they eluded us entirely.

During the day *Nycteris hispida* sleeps suspended by its feet from a rafter in some dark, unused room, where seldom more than three or four gather, or swinging from a twig in a mango or other shady tree, a most grotesque little creature with twitching ears, but attracting no attention because of its small size. One foetus was found in the uterus of a female at Stanleyville on August 8.

At Boma bats of this species were not seen in the houses, but fed about the papyrus in the evening just as *N. pallida* does in the Upper Uele. The type locality is Senegal, but Dobson records specimens from Khartum to the Cape of Good Hope.

#### 14. *Nycteris pallida* sp. nov.

The smallest and the palest of our species of *Nycteris*, only 3.75 inches (95 mm.) long, was discovered in the papyrus swamps about Faradje and Vankerckhovenville. In this open country of grass and bush, the hollows are very often occupied by long winding marshes filled with this noble sedge, which offer refuge to a fauna quite their own. As the darkness is falling rapidly, flocks of weavers drop in to roost, the slaty-black crakes (*Limno-*

*corax niger*) cluck softly as they thread their way among the papyrus stalks or climb up for the night. Then new evidences of life appear, the flickering shapes of small gray bats, fluttering in and out, in most aimless fashion, along the pathways or tunnels through the vegetation, which rises to a height of 12 to 15 feet. About its borders they also hover, always looking as though just about to hang up, raising in the zealous collector's breast false hopes of a more favorable shot in the fast deepening twilight — hopes which are never realized.

During the day these little bats are more difficult to find, for they retire farther into the swamp, where mud and water are deep and the way barred with tangles of old dry stalks. They never collect in large parties, but are generally seen to take wing singly, fly 15 or 20 yards, and hang themselves up again just beneath a bushy papyrus crown, where they are anything but apparent.

These papyrus swamps offer good shelter throughout the year, because they are usually spared by the fires that sweep the bushveldt annually. Though they dry out considerably by the end of the rainless season, it is in December, while they are still filled with water, that most of these bush-fires take place.

*Nycteris pallida* was never observed in houses, but is sometimes to be found hanging in the tall bamboo reeds along the bank of the River Dungu. Its young appear to be born at the beginning of the rains, as two females taken on April 18 were each carrying one about with them.

#### 15. *Nycteris avakubia* sp. nov.

The single example of this new species, which closely resembles *N. arge* though of larger size, was taken in a house at Avakubi, where three representatives of the genus live together. Fig. 3 (p. 426) is copied from a water-color sketch made from the specimen the day it was caught.

#### 16. *Nycteris arge* (Thomas).

The common long-eared *Nycteris* of the Ituri forest and southern Uele has a tail as long as the head and body, measuring 4.5 inches (114 mm.) over all. Its wings spread 10.5 inches (267 mm.). As noted under *N. hispida*, this species is seen commonly about houses, circling around in illuminated rooms, or perhaps flying back and forth for long periods beneath a veranda roof, noiseless save for the light pulsations of its wings when it makes a sudden turn. It may remain during the day in deserted dwellings, suspended from the roof by its small feet.



The type locality of the species being Efulen, Kamerun, the present records extends its range very widely to the east.

17. **Nycteris major** (*Andersen*).

This large species, whose wings when spread measure 12.25 inches (311 mm.) has ears not quite so long as those of *N. arge*. It was found by us only in the open country, at Faradje and Garamba; but even there it is not common. Strangely enough, the species was described from the Ja River, in the forested part of the Kamerun.

MEGADERMIDÆ.

18. **Lavia frons affinis** *Andersen & Wroughton*.

Plate L.

The curious orange, yellow, greenish, and brown tints are spread so harmoniously over the huge nose-leaves, the enormous ears, and the broad wings that one is surprised to find such strange beauty in a bat otherwise so modest in its slate-gray, long-haired body. Its length of only 3.12 inches (79 mm.) would be deceptive if compared with that of other insectivorous bats. The tail in the Rhinolophidæ is very long, but in the genus *Lavia* is reduced to a coccyx and therefore not visible externally, though the inter-femoral membrane is very well developed (Fig. 22, *B*). Even its wing-spread of 15 inches (380 mm.) appears small if one remembers the broad outlines of the bat on the wing. There is a tremendous contrast between the rapid direct flight of *Nyctinomus*, with its narrow pointed wings, and the unsteady wavy dashes of *Lavia frons*, with its clumsily rounded wings,—indeed just as between a swift-sailing falcon and a fluttering grouse.

Adult males have peculiar yellow glands in the skin of the whole lower back, over which the long hair, otherwise slate-gray, assumes a brownish tint, apparently colored by the slightly odorous excretion. Right above the anus the females have two teat-like excrescences (5 mm. in length) common in the Rhinolophidæ.

One large foetus in March and five young taken from October to April, would prove that they have only one young and breed at different periods. We did not notice them from May to August, as they become much less conspicuous when the foliage is denser, but we believe that they reproduce throughout the year.

The young, as in other bats, clings to the breast of its mother and is thus carried about even during flight. We were rather surprised to see that one, four-fifths the size of its mother and able to fly, was not only carried about occasionally but still depended for its nourishment entirely on sucking, since its stomach contained only milk. As the young grows larger, the mother hunts alone, leaving her offspring hanging to a twig, but on her return it quickly climbs back to its accustomed place on her breast. If the mother is scared away the precious burden is never considered too heavy to carry.

They are far more diurnal than any other bat we observed, and this has been corroborated by all travellers who have seen them. They seem to have no definite time for sleep, as they proved to be wide awake even when approached cautiously, and do not mind the glare of the sun. When disturbed they took wing quickly, turning with such sureness toward another tree that they seemed to have selected long before the branchlets where they wished to cling.

They were common at Faradje, where they liked to swing from the twigs of rubber trees (*Manihot*) either by one or both feet. They did not disdain protection in the dense foliage, but in December and January often hung on bare twigs, shifting to a more shady place if the direct rays of the sun struck them. Thorny, sparsely-leaved trees, such as acacias, to which they like to cling in eastern Africa, are not numerous in the Uele district.

At Faradje many bats hunted every evening; some high in the air over open spots like *Taphozous mauritanus*, others like *Mops* showed a liking for the free expanses over the Dungu River, while *Eptesicus faradjius* kept close to the ground near the houses. All of these had small ears and hair-covered or fleshy muzzles and flew in the open. But it was evident that *Lavia frons affinis* derived some genuine advantage from its big, highly sensitive nose-leaves and tremendous ears. No doubt it is also greatly assisted by the fine reticulation of sensory nerves which are extremely well developed in the membranes. It certainly can dodge in and out between the bushes and trees with an ease that calls forth admiration. Starting to forage early, before sunset, it would never remain on the wing in the same constant manner as other bats but alighted very often between mouthfuls of tiny, hard-shelled insects.

Late in January not far from their roosting trees the grass was set afire just about noon. As usual, insects, to escape the advancing flames, tried to hide in great numbers in the grass. These bats would then dive after some of the insects that passed nearest, just as eagerly and skilfully as the birds that snatched them far above the flames. Their method is utterly

different from that of other bats, which feed with such ease on the wing that one can seldom ascertain whether or not they have been successful in their pursuit. These long-eared bats after seizing an insect return at once to their perch. Here they move about nervously, busy with either foot or wing until the tiny jaws have disposed of their prey. They feed on relatively large insects with rather hard integuments, as shown by the contents of their stomachs.

Colonel Roosevelt gives a most interesting and vivid account of their feeding habits in his 'African Game Trails,' page 399:

"In catching insects they behaved not like swallows but like flycatchers. Except that they perched upside down so to speak, that is, that they hung from the twigs instead of sitting on them, their conduct was precisely that of a phoebe bird or a wood pewee. Each bat hung from its twig until it espied a passing insect, when it swooped down upon it, and after a short flight returned with its booty to the same perch or went on to a new one close by; and it kept twitching its long ears as it hung head downward devouring its prey."

The wide range of the genus *Lavia* across Tropical Africa outside of the equatorial forests seems to be dependent on the neighborhood of water which, of course, only indirectly influences its distribution. Many of the rivers, swamps and lakes, even in the more arid regions, are fringed with trees and bushes that offer very convenient roosts. These bats are usually found in just such sites, but they avoid houses and cliffs. Another reason may be that in the neighborhood of water and, particularly about swamps, certain insects upon which they like to feed are especially common.

#### RHINOLOPHIDÆ.

##### 19. *Rhinolophus hildebrandti eloquens* Andersen.

A rather light brownish-gray horseshoe-bat, with very dark-brown wings. Compared with *R. abæ*, from the same region, it is seen to be slightly lighter in color, with larger ears. Its measurements are greater throughout; total length approximately 3.75 inches (95 mm.); tail about 1.1 inches (28 mm.); expanse of wings 14 inches (355 mm.).

Our three specimens from Aba were captured in caves, where they mingled with *Rhinolophus abæ* and other bats. They extend the range some distance to the northwest, as this small race of the East African *R. hildebrandti* was first found in Uganda.



20. **Rhinolophus abæ** sp. nov.

Fur rather long and soft, grayish-brown above, drab on abdomen; wings dusky brown. Outlines of ears and nose-leaves are similar to those of *R. hildebrandti eloquens* and *R. axillaris*. Total length, 3.3 inches (84 mm.); tail 1 inch (24 mm.); spread of wings 12.7 inches (320 mm.).

From our experience in December, 1911, this appeared to be the commonest *Rhinolophus* living in the rocky hills about Aba.

21. **Rhinolophus axillaris** sp. nov.

Plate LI, Fig. 2.

The specific name refers to the two patches of stiffened rufous hairs, usually found on the sides of the breast, just outside the mammæ. Their function is obscure, but in one of our specimens, a male, the hairs are pale yellowish, and a hardened gummy secretion adheres to them. This individual, moreover, is lighter and yellower in the rest of its pelage, being cinnamon on the back, and pale cinnamon-buff below. The five other specimens are gray-brown, similar in color to *Rhinolophus abæ*. Average measurements are: total length 3.1 inches (79 mm.), tail 1 inch (26 mm.).

This is not a common species, even at Aba, the only locality from which it is known. Two examples were first captured singly in caves inhabited by other bats, *Rhinolophus* and *Hipposideros*; and then three were brought to us by some natives, in a basket containing also specimens of *R. abæ* and *R. hildebrandti eloquens*.

Certain of these forms now known only from Aba, may perhaps range southwestward to the hills near Vankerckhovenville, where conditions are very similar.

22. **Hipposideros caffer centralis** Andersen.

Plate LII, Fig. 1.

It would be difficult to describe in detail the coloration of the common leaf-nosed bat; so variable is the pelage that different individuals appear to represent distinct species. Some shade of brown is most frequent, with the under surface only slightly lighter, but many are dark brownish-gray (probably young), whereas a few of either sex are of a beautiful bright cinnamon-rufous over the whole body, the flight membranes always remaining brownish-black.

The ears are comparatively short and wide, dark gray like the nasal outgrowths (Plate LII, Fig. 1). Just above the latter, hidden in the fur

of the forehead, the males have a small invagination of the skin, through the opening of which protrude a few wisps of hair. There is no eversible pouch near the anus as in *H. langi*, and females lack even the frontal sac, but have a very small bunch of short, stiffer hairs at that point. The pair of vestigial mammæ in the pubic region are usually small in the females, practically absent in males.

Exact measurements are rather variable, but the usual length is about 3.5 inches (90 mm.), with a tail of 1.4 inches (35 mm.), and the wing-spread is 11.4 inches (290 mm.).

One cannot travel very far in the Upper Congo without making the acquaintance of this rather sociable species. Arriving after a long march in a government station, we are met and warmly welcomed by the courteous chef de poste, who accompanies us at once to the house placed at our disposition, probably a cool brick structure with loosely fitting wooden blinds at the windows, and plenty of open space for ventilation between the walls and the gabled roof. Such a house is ideal for the region, in so far as materials are available, and a welcome change after weeks or months under canvas and in mud-walled rest-houses.

Perhaps it is a long time since some passing officer last occupied it. The door is unlocked, and in go our boys to install our camp furniture. Everything is dark, and a slight musty odor is perceptible. A number of dark forms, worried by this unwonted disturbance, flit about the room. But our boys are wise in the ways of bloodthirsty mammalogists. They come out again, close the door cautiously and report: "There are birds in the house." 'Ndeke' however means bats as well as birds, so preparations are made to secure specimens, and butterfly nets pressed into service.

Our Belgian friend meanwhile looks on with kindly amusement, and we cannot help laughing at our own awkwardness and the adroitness of our quarry; but the joy of success is not always complete. Nine times out of ten, we have to conceal a slight disappointment, for we have only captured an old friend, *Hipposideros caffer*. Small wonder, for this is the commonest bat in abandoned native huts, old outhouses or magazines, or any other darkened untenanted building, where they gather in numbers up to 50 or 60, hanging to the walls or ceiling, making little disturbance and flying with scarcely a sound. When forced to leave they make for the nearest retreat in some adjoining house; it goes without saying that they are perfectly acquainted with the neighborhood.

Native huts, while inhabited, offer no suitable refuge, on account of the great simplicity of their structure, and mainly because of the smoke from the fire, which even in hot equatorial Africa is kept burning there, especially at night. Small colonies may however be found in the sepulchral

huts left in the midst of villages of the forest negroes. It is only natural that a bat roosting so often in houses should not hesitate to enter them at night; and so, among the bats we captured in lighted rooms where they had come in pursuit of insects, *Hipposideros caffer centralis* was the most common. Only at Aba did we find it in caves, and even there we took but 3 specimens.

The range of this subspecies extends in a belt across Equatorial Africa from British East Africa to the Lower Congo, while other races of *Hipposideros caffer* occupy the remainder of tropical Africa.

23. ***Hipposideros caffer niapu*** subsp. nov.

The 10 specimens upon which this new subspecies is based were taken in a large shed at Niapu, where a flock of about 50 were making their home. They did not differ in habits from *H. c. centralis*.

The frontal sacs are better developed in the males than in *H. c. centralis*, and the same is true of the abdominal mammæ of the females. The forearm is longer, the wings spreading 12.7 inches (323 mm.), while the length is about 3.5 inches (88 mm.), with a tail of 1.2 inches (30 mm.).

24. ***Hipposideros abæ*** sp. nov.

The texture and often the color of the fur is rather like that of the species of *Rhinolophus* which frequent the same haunts. Individuals are numerous which show an ochraceous-tawny color, brightest below, for the fur of the back is tipped with dark brown. These dark tips always persist, but the rest of the hair is more often of a pale smoke-gray. The broad wings are brownish black, with an expanse of 12.6 inches (320 mm.); the length from nose to tip of tail is 4 inches (102 mm.), the tail 1.4 inches (36 mm.).

Males have a frontal sac enclosing dark stiff hairs; females have a bunch of hairs without the sac.

This is perhaps the commonest of the cave bats about Aba, and lives in flocks of hundreds in the darker recesses, taking wing when disturbed, but very averse to risking itself out in the open sunlight.

25. ***Hipposideros nanus*** sp. nov.

A very small species, as shown by its measurements: total length, 2.6 inches (66 mm.); tail, 1 inch (25 mm.); expanse of wings, 9.7 inches (246 mm.). It bears some resemblance to *H. caffer*, but the fur extends higher



up on the back of the ears, and the coloration is lighter. The pelage of the back is hair-brown at tip and base, whitish in the intervening portion; whereas that of the under surface is drab at the tip, grayish-white subterminally, and the basal half deep mouse gray. The membrane of the wings is blackish brown.

Represented in the collection by only a single specimen, secured in a house at Faradje.

26. **Hipposideros langi** sp. nov.

Text Figs. 4-6, pp. 435-437.

The hair all over the body of this large leaf-nosed bat is exceptionally long and fluffy, for the most part dark brown, but becoming lighter and grayer just before ending in the blackish tips. The broad wing membranes are likewise dark brown, and the short tail makes up only about one-fourth of the total length of 4.45 inches (113 mm.); 16 inches is the extent of the wings.

More unusual than the complex nose-leaves are the curious eversible pouches (Fig. 4, p. 435), lined with long stiff hairs, which adorn the forehead in both sexes, though they may be concealed by the surrounding fur. These are found in several related species, like *H. gigas*. But the male of *H. langi* has another much larger pouch between the penis and anus, with glandular skin producing a strong odor, which might perhaps be mistaken, when evaginated, for a scrotum. As a matter of fact, however, the testes are placed wide apart, lateral to the penis, and covered by ordinary hairy skin. The pouch can be turned out after death by pressure on the surrounding skin, and exposes its stiff rufous hairs as shown in Fig. 6 (p. 437). Though lacking in the female, it is represented perhaps by the longer hairs arising in front of the vagina (Fig. 5, p. 436).

The frontal pockets are already well developed in half-grown young, which like the adult males show rudiments of the two teat-like processes found close together in the pubic region. The latter are especially long in adult females (Fig. 5) but not connected with mammary glands. Possibly these appendages are sucked by the young and aid the mother in carrying them.

Very seldom is this bat seen flying about at night, perhaps because of a dislike for open spots; and yet it is not rare, sometimes roosting in parties of a dozen. According to native informants they hang in the dense foliage of trees and bushes, but at Avakubi we found a large hollow tree in the rubber plantation tenanted by them. Its cavernous trunk opened only near the ground; and standing in this aperture, one could hear the muffled beat

of their wings when they were disturbed. By shooting blindly up into the darkness three specimens were secured, and another was taken by smoking. In spite of these disturbances they returned to this retreat during four months.

Among six examples captured in late April three were very young, and two gravid females were collected towards the end of January; so February is evidently the month, in the Ituri, during which they bring forth their young.

*Hipposideros langi* is clearly a forest species, and certainly of wider distribution in the Ituri than indicated by our records, though probably reaching its northern limit near the Uele River.

27. ***Hipposideros gigas niangaræ*** subsp. nov.

Plate LI, Fig. 1.

Though the distinction of being the largest insectivorous bat of Africa is claimed for *Saccolaimus peli*, the present subspecies misses it by only a fraction of an inch. In spite of its short tail it measures 5.4 inches in length (137 mm.). The wings when fully extended show a width of 25.6 inches (650 mm.). Their long-haired, light brown shoulders are limited on the back by a Y-shaped band of short dark brown hair that reaches forward to the white base of the wings, a combination distinctive of this genus. The face and under side are buffy gray. The peculiar nose-leaves, the bristly hairs and sharp-tipped ears are well shown in a photograph (Plate LI) taken from the fresh specimen.

On the forehead there is a small sac, as in *Hipposideros langi*, with bristly hairs; but our specimen is a female and shows only a patch of long hairs in front of the vulva.

This is not a common species in the regions where we collected, for the only specimen we saw flew in under the veranda of a house at Niangara one evening in early June. It had been gorging itself with winged termites, remains of which were still stowed in its capacious cheeks.

VESPERTILIONIDÆ.

28. ***Myotis bocagii bocagii*** Peters.

This is the smallest of the three subspecies of *Myotis* represented in our collection. Though nearly adult our specimen measures only 2.75 inches (70 mm.) in length. The color is cinnamon above, light gray below, and

the wings are darker than the ears. When it is compared with similar specimens of *Myotis bocagii cupreolus* the difference in size is greater than between the latter and the largest race, *M. bocagii hildegardæ*.

This bat with its cinnamon upper side attracted our attention as it was being carried across the courtyard by a chicken, which had evidently found it dead in the garden. Fortunately it was still in good condition.

### 29. *Myotis bocagii cupreolus* Thomas.

Its gorgeous color together with its small size place it among the really beautiful bats. The vinaceous-rufous and ferruginous tints of the upper side bordered by the blackish wing membranes and fusing into the pinkish cinnamon of the under side make a pleasing combination of colors. The obtuse muzzle and the tiny eyes are practically hidden in the fur of the head, from which emerge laterally the rather long ears, slightly rounded at their tip and concave on their posterior edge with a narrow tragus reaching to their middle. Its total length is but 3.4 inches (87 mm.) and the expanse of the wings 10 inches (255 mm.). According to the contents of the stomach, this species feeds on minute insects of great variety, including remains of Orthoptera. Only one young is brought forth, as two records tend to prove, the first from the beginning of January, a large embryo, and the second from the end of June, a very young male still hairless on the under side but already showing on the upper side the rufous coloration of the adults.

With regard to its habits it may be introduced as a close associate of that other more common vespertilionid, *Pipistrellus nanus* (p. 441). Indeed the Mabudu at Bafwabaka, who are well acquainted with them, often catch both species, as they drive them out of the same bunch of bananas; and they call this coppery banana bat the "big red brother" of the dark pipistrelle. Among their own tribe they have a few people considerably paler than the black majority, and to avoid all doubt as to the interrelationship of the bats they point to such light-brown individuals among themselves. Then they feel happy that they can offer such convincing proof to the white man, "whose brothers are always white."

Our series of skins shows that adult males of *Myotis bocagii cupreolus* are of a distinctly brighter vinaceous-rufous color than females and young, especially on the lower back, whereas in *Myotis bocagii hildegardæ*, which is paler, both sexes attain the same intensity in the rufous hues.

It is perhaps interesting to note that in referring to *Myotis bocagii* and in describing *M. bocagii cupreolus* and *M. bocagii hildegardæ*, Thomas<sup>1</sup>

<sup>1</sup> Thomas, O. Ann. and Mag. Nat. Hist. (7), XIII, 1904, p. 407; p. 209.



made some remarks on the comparative brightness of color of these forms which our larger series from the same locality would show to be purely individual. Dr. Allen has pointed out (p. 440) that "the length of the red tips to the hairs of the back varies from 2 to 5 mm. in length in specimens taken the same day." Furthermore the length of the hairs, given by Thomas as 5 to 6 mm., in our series of both subspecies varies from 4 to 8 mm. and the longer ones appear somewhat shaggy. The bright color cited above may, in worn specimens, fade to cinnamon on the back and paler on the under side. The specimens with very short red tips look somewhat dusky since the dark bases show through.

Our specimens are all from Bafwabaka and Medje, but the type locality is Efulen, Kamerun, nearly 1000 miles westward across the forest. Its habits would indicate that it has as wide a distribution as *Pipistrellus nanus*, but since it seldom visits villages and keeps away from houses it is not liable to come to the notice of travellers.

### 30. *Myotis bocagii hildegardeæ* Thomas.

In addition to the remarks under *M. bocagii cupreolus* we may state that this is an equally pretty bat though slightly paler and somewhat larger. Its total length is 3.55 inches (90 mm.) and the spread of wings 10.25 inches (260 mm.).

We found it living in the same banana plantations with *Pipistrellus*, though most of them were found hiding beneath the dead overhanging leaves of plantains and only a few between the fruits in the bunches.

*Myotis bocagii hildegardeæ* undoubtedly replaces *M. bocagii cupreolus* outside the rain-forest in the more open country. Its type locality, Fort Hall at the foot of Mt. Kenia, lies nearly 600 miles eastward of Aba.

### 31. *Pipistrellus nanus* (Peters).

This pipistrelle is one of the very small African bats; it measures only 3 inches (76 mm.) from the nose to the end of the tail, the latter accounting for nearly half the length. The expanse of the dark wings is 7.25 inches (184 mm.). The fur is darker basally, and though warm sepia is the most common shade, blackish-brown specimens occur occasionally, the under side being always a little lighter. The variation in color is individual and not influenced by age or difference of sex.

On rare occasions two young are born. We had at least one female in August with two embryos, though in December and January single young

were observed. One of them, more than half-grown, was still carried by its mother, as it happens in nearly all bats.

Their flight is rather unsteady, nearly fluttering, as they zigzag between the frayed-out leaves of the bananas, but rarely do they make abrupt turns. They seem to avoid the open places of villages where other bats are most conspicuous.

The distribution of *P. nanus* includes nearly all of the Ethiopian and Malagasy regions. Thus it is among the most widely distributed of African bats, and naturally we found it in both the open and the forested regions.

Sometimes they hide in the thatch of the houses or pursue tiny insects around a lighted lamp; but we found them, together with another form of the orange-rufous *Myotis bocagii*, chiefly in the native gardens. They may take refuge underneath the hanging dry leaves of plantains or wherever they find suitable cover. Their favorite hiding-places are the nearly full-grown bunches of green bananas. They crawl into the darker spaces between the fruits, one or two together. Here they hang in safe and comfortably cool surroundings huddled up in a tiny ball from which the small ears stand out laterally, or cling to the bases of the fruit with thumbs and feet. No wonder that they show special adaptations. The thumb has a large wrinkled callosity and tiny furrows on its under side that by contraction may act as a sucker. Their feet also show similarly wrinkled soles and toes, and thus appear well fitted for crawling and hanging on such smooth surfaces as those of plantains and bananas.

Naturally such a shelter is available only for a short period, hardly exceeding a month, as the plantains become ripe enough to cut down for consumption. Therefore these pipistrelles have no stable household like most of the molossids, which live for decades in the same hollow tree and perhaps for ages in the same rocky cleft, but on the contrary have to keep on the move. From time to time negroes in these regions abandon their villages and plantations, and the pipistrelles in all probability follow. Vagrancy is thus forced upon them and their ubiquitous appearance seems to be merely a consequence of the peculiar conditions offered by the cultivation of plantains and bananas. Though we found them most common in regions where such plantations are numerous, we have no doubt they can adjust their habits to other conditions.

They have hardly any voice, but taken alive and held in the hand these tiny bats snap their mouths open amazingly wide, to an angle of  $120^{\circ}$ , and what is still more astonishing they keep it in that position apparently without any effort. A comparison with most living carnivora shows that the latter cannot open their mouth, hard as they may try, even to a right angle, only far enough to bite at their victims or to crush bones. Years ago, the

sabre-toothed tiger offered to zoölogists the problem, whether its jaw muscles might have permitted the effective use of its gigantic canines in the normal manner. But even so its jaws would never have been farther apart, relatively speaking, than those of many insectivorous bats. With these it is undoubtedly an adaptation merely to increase the gape, so as to facilitate the gathering of insects during flight, just as with the swallows and goatsuckers. Considering the extraordinary sharpness of their teeth, these tiny bats need no specially strong masseters to deal with their habitual prey of insects. The lower jaw in fact is comparatively weak, there is never any long ascending ramus, for that would make it a practical impossibility to open their mouths so wide. A short broadened surface with a rather low coronoid is the general rule for the attachment of the jaw muscles, and the lower part of the mandibular symphysis is often so strengthened that muscles for the lowering of the mandible may act thereon in a special way. The latter features are paralleled to a remarkable degree by the shape of the mandibles of sabre-toothed tigers, but not by other felids.

These tiny bats too often play an unfortunate part in the amusement of black children, who know their haunts so well that to capture one or more of them becomes a passionate sport. With wing membranes torn these bats can move but slowly on the ground; but their readiness to defend themselves with wide-open mouth spurs the youthful tormentors on and makes them capital and entirely inoffensive playthings for youngsters that are to be kept in good humor. Their cruel feelings seem to soar higher and higher as the poor, teased bat becomes more helpless. Not satisfied with merely torturing it in real cannibal fashion, they finally end the troubles of the doomed pipistrelle by spiking it upon a splinter of wood and roasting it alive. Since it is too small to excite the appetite of adults, the children can enjoy the tiny morsels of meat from the breast in unchallenged delight. In this way these savage imps enjoy themselves while their mothers drudge about the plantations in the hot sun.

### 32. *Pipistrellus abaensis* sp. nov.

The habits and general proportions are so nearly the same as those of *P. nanus* that no repetition is necessary; the fur however is of a lighter brown color. This species undoubtedly represents a paler form from the bushveldt region of the northeastern Uele district. Our experience shows that its variation in color also includes a dark bone-brown phase, which seems to be as common as among a series of *P. nanus*.

It was in the hands of boys that we saw the first fifteen of these bats; among them were two of the darker variety. Since they were all mutilated



we asked the children to show us their haunts. They scampered off into a nearby plantation, and by poking in all the bunches of plantains secured six more. Only three could be prepared for our collection; of these one was fortunately of the darker phase.

### 33. *Pipistrellus musciculus* Thomas.

Four years ago Oldfield Thomas when describing this pipistrelle from Bitye, S. Kamerum,<sup>1</sup> said that it was probably the smallest bat yet known. At all events it is smaller than its rather abundant congener, *P. nanus*, for our specimen, an adult female, measures only 2.45 inches (62 mm.) in total length, of which .87 inches (22 mm.) are to be discounted for the tail, and its little wings stretch but 6.4 inches (162 mm.). In length it is thus exceeded half an inch (12 mm.), on the average, by *P. nanus*; and a further distinguishing mark is the lighter color of its pelage, a uniform umber-brown.

In the latter part of February, a period at which even in the Ituri forest there is a spell of dry weather, we were camping in the vicinity of Avakubi beside one of those open muddy areas in the forest, known locally as an "edo," where the elephants and buffaloes come during the rainy season to trample and wallow in the sticky mud. But now the ground had dried out, preserving the deep imprints of gigantic feet; and only a couple of small damp spots remained over which numbers of insects danced and buzzed as we came out of our tent in the early morning. Several times, just as day was beginning to break, we noticed two tiny bats feeding there. Making these spots one end of a swift elliptical course, they snapped at the insects and skimmed off so rapidly as to defy, in this faulty light, either recognition or a successful shot. Then with the increasing day they suddenly vanished.

One morning however as I stood watching, an upward twist carried the bat close to a stout horizontal limb, about 20 feet from the ground, and immediately it was lost to view. Further inspection showed that this bough had a small knot-hole on the under side; so it was cut off and thrown to the ground. A long hollow traversed it. Chopping into this and poking a long switch through it disclosed a hive of tiny black bees (*Trigona*) but no bat, and as they munched this tiny store of honey my men began to assure me that my eyes had deceived me. The search was about to be relinquished when we happened to look again at the knot-hole. Just on the other side in a shallow cavity there crouched this insignificant little creature alive and quite uninjured in spite of its fall. So far as we

<sup>1</sup> Ann. and Mag. Nat. Hist. (8), XI, 1913, p. 316.

were then aware it did not differ from *P. nanus*, but our attention was drawn to two bugs (family Cimicidæ) clinging to its wing membranes.

34. **Scotozous rüppelii** (*Fischer*).

Creamy white on the under side and mouse-gray above, these are the characteristic colors of this pretty species. The dark obtuse muzzle is nearly hidden in the long fur of the head, from which the slightly elongate but rounded ears stand out laterally. The total length of this male is 3.2 inches (82 mm.), the wings when folded are pale brown, but when fully opened appear nearly transparent and measure 8.25 inches (209 mm.) across.

Like *Scoteinus schlieffenii* it has a large external penis, a half inch long, covered with short white hair directed basally, with a penial bone a quarter of an inch in length; the testes are placed laterally to the tail behind the anus.

Several of these bats were fluttering about the oil palms at Poko on the Bomokandi River, but this male entered a lighted room and could then be easily caught. It was known to occur on the mainland opposite Zanzibar, northward to Egypt and westward to Lake Albert. Its discovery at Poko in the Uele district thus extends its range considerably to the westward.

35. **Eptesicus tenuipinnis** (*Peters*).

A very small brown bat with filmy white wings, actually transparent. Total length, about 2.8 inches (72 mm.), tail 1.14 inches (29 mm.), spread of wings 7.25 inches (184 mm.). Fur of upper surface mummy-brown, sometimes tipped with whitish, that of lower surface dark brown basally, but with whitish ends so that the abdomen appears nearly white. The muzzle is decidedly swollen laterally, and its skin in life is yellowish pink, but whiter just around the nostrils. Ears, wing and tail membranes, as well as claws, metacarpals, and phalanges white; arms and feet dark pink.

Although distributed from Lagos and other parts of West Africa eastward to Lake Victoria, this strikingly colored little bat came to our notice but once, at Ngayu in the Ituri forest. A hollow tree was cut down, in which seven of them were found hanging.

36. **Eptesicus ater** sp. nov.

Similar to the preceding species but darker — fur of the back brownish black — and slightly smaller: total length 2.7 inches (68 mm.), tail 1.15 inches (29 mm.), expanse of wings about 7.15 inches (182 mm.). The wing

and tail membranes are of a transparent white, but the ears and face darker than those of *E. tenuipinnis*.

This new species was found just to the north of the forest region, at Niangara and Faradje, and is represented by four specimens. One of these was captured as it circled around under the roof of an open native hut, an hour after nightfall. Another was found in the crop of a hawk, *Machæramphus anderssoni*, which had been taking its evening toll of bats.

### 37. *Eptesicus faradjius* sp. nov.

Total length about 3.5 inches (90 mm.), wing-spread 10.5 inches (267 mm.). The long tail, with the pointed interfemoral membrane reaching to its very tip, may sometimes take up even more than two-fifths of the total length. The silky fur on the dorsal side is uniform in color but the individual variation, which has nothing to do with either age or sex, is rather confusing. The reddish-brown specimens show a strong contrast with those of a very faded or dark brown shade. The ventral side is always lighter, especially on the abdomen. The wing and interfemoral membranes are whitish and translucent, though the latter have often a distinct brownish hue in the darker specimens.

We often scared these small bats out from the dense clusters of foliage of either low trees or bushes. In Faradje they clung to the brick walls or to the rafters or even to a single grass stalk hanging from the thatch. There were as many as six together and they preferred the more secluded and darker places. When approached during daylight they were always on the alert and moved quickly out of sight, climbing over the brick walls or deeper into the recesses of the thatch. When disturbed in trees they showed even in the brightest sunlight no bewilderment in the selection of another hiding place.

Like *Taphozous mauritanus*, they were especially numerous in the house and even in native huts right after the beginning of the dry season, when the grass is habitually set afire all over the country. The trees and bushes are then leafless and these bats naturally find a more suitable shelter in human habitations.

Early in the evening they start to pursue their minute prey and usually keep only some five feet from the ground, flying back and forth outside of the houses without fear of human beings, their wings whirring distinctly as they pass. They rarely visit lighted rooms.

They were collected only at Niangara and Faradje and are probably restricted to the bushveldt region north of the tropical rain-forest, especially as we never observed them either near Médje or Avakubi, where we made extensive collections.



38. **Eptesicus minutus minutus** (*Temminck*).

True to its name, a very small species: total length 2.56 inches (65 mm.), tail 1.15 inches (29 mm.), expanse of wings 7.4 inches (188 mm.). Besides rivalling *Pipistrellus nanus* in size, it resembles it in color: fur of back and throat bone-brown, but hair of breast with light buffy tips, which increase in length on the belly, until beneath the tail the hair has become nearly white. Flight membranes brownish-black.

A widely distributed species, extending over a large part of the continent, but represented in our collection by only two specimens, from the northern border of the forested region. At Niangara one was caught after it had flown into a house at night; the other example was shot at Isiro as it flew about in the open, near a dwelling.

39. **Eptesicus garambæ** sp. nov.

Despite its larger size, this new species recalls *Eptesicus minutus* by its brown pelage and brownish black wings. Yet the brown is lighter, for while the fur is deep brownish-black basally, its outer surface on the back is snuff-brown. On the ventral surface the resemblance is closer, the tips of the hair being cartridge-buff. Posteriorly these tips become longer until near the vent the pale color extends to the whole hair. Measurements: total length 3.1 inches (78 mm.), tail 1.27 inches (32 mm.), expanse of wings 8.35 inches (212 mm.).

Our only specimen was collected at Garamba, just on the boundary between the Upper Uele district and the Bahr-el-Ghazal.

40. **Mimetillus moloneyi** (*Thomas*).

The general appearance reminds one very strongly at first glance of a tiny molossid bat. This is due to its short brown fur, rather broad face, and narrow wings; but a closer view destroys the illusion; the tips of the wings do not fold in, there are no spoon-hairs on the toes, and the tail is entirely included in the membrane. The latter is brownish-black, and so are the wings, as far out as the fifth digit, but from there to the tip they are whitish and transparent. Head, body, and tail measure 3.3 inches (84 mm.), the extended wings only 6.85 inches (174 mm.).

*Mimetillus moloneyi* has smaller wings as compared to the size of head and body than any other bat with which we are acquainted (see Fig. 22). Not only the forearm, but the phalanges especially are extraordinarily

shortened. In the original description (Ann. and Mag. Nat. Hist. (6), VII, 1891, p. 529) Mr. Thomas suggested on this account that its manner of life was less aërial, that possibly it climbed about in search of food on trees or rocks. It is nevertheless our opinion that it probably roosts by day in cavities in trees but that its habits do not differ so markedly from those of other bats. Indeed the stomach contents of a specimen shot during flight at Avakubi consisted wholly of remains of small winged termites, as proved by microscopical examination. It was going at a fair speed and very directly but with rapidly beating wings over the open parade-ground. Whether the manner of flight was due simply to the shape and small area of the wings was not quite clear, for this individual was just recovering from two severe wounds on the shoulder and neck, probably inflicted by that relentless foe, *Machærhamphus anderssoni* (p. 552).

Another example was taken from the stomach of such a hawk, and had undoubtedly been captured on the wing in the usual style, for we had watched the bird, with its mate, in the gathering dusk, as they circled out from a tall dead tree, high over the other tree-tops, returning occasionally to their conspicuous perch.

First described from Lagos, this rare and peculiar bat is an inhabitant of the forest region, as shown by the localities, Stanleyville, Avakubi, and Medje, from which our specimens come. It is not surprising therefore that it has also been collected on the island of Fernando Po.

#### 41. *Scoteinus schlieffenii* (Peters).

The presence of this small bat in our collection is due to its ardor in following its small prey close up to a lamp, lighting an open veranda at Niangara.

It is only 3.2 inches (82 mm.) in length and the expanse of the wings is 8 inches (203 mm.). Sepia on the upper side and silky white on the lower surface are the predominant colors. Its stout somewhat short-haired body and the short blunt head give it a slight resemblance in form to a molossid; the broadened dark wings, the tiny laterally projecting ears and the tail, supporting the interfemoral membrane to the very tip, are distinguishing characteristics.

Our specimen is a male. It has a relatively enormous penis, 2 mm. in diameter, clothed with short white hair directed basally and terminating in a pad with a curious escutcheon-like design; the penial bone is 14 mm. in length. Each nostril ends in a smooth slightly projecting pad. Beneath the throat is a small gland opening on the skin by two tiny orifices.

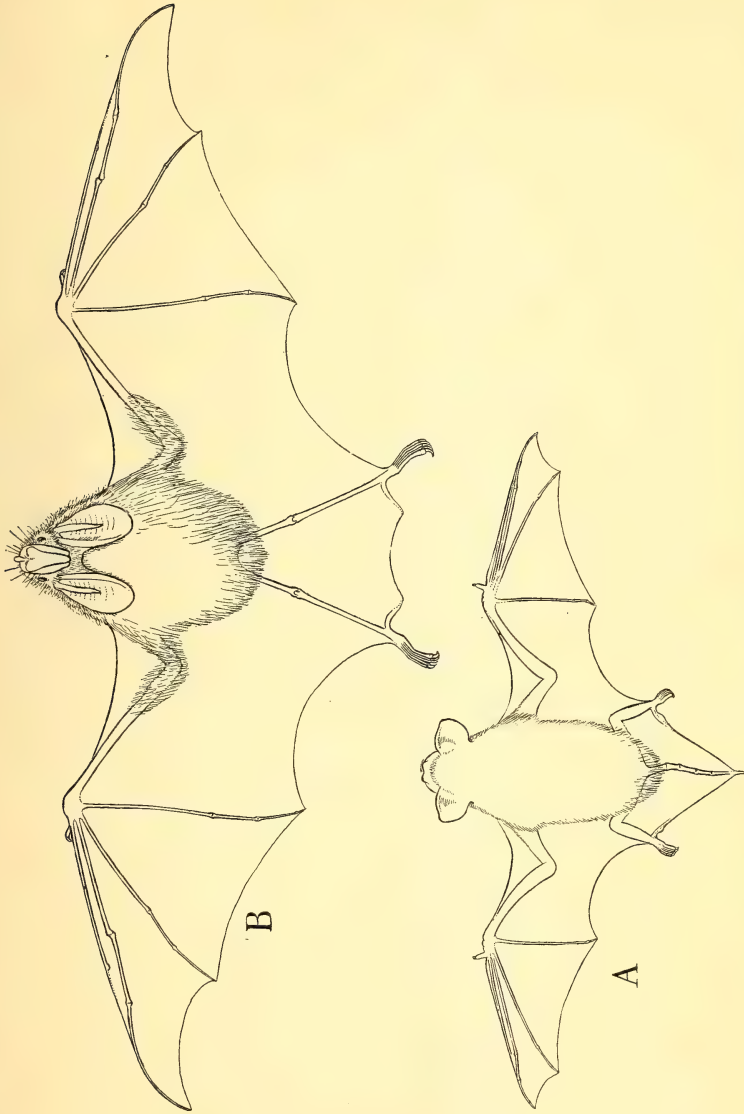


Fig. 22. A. *Mimotillus moloneyi*,  $\frac{1}{3}$ . B. *Lavia frons affinis*,  $\frac{2}{3}$ . In these two figures the length of head and body is the same, and the extreme difference in relative wing-area is clearly shown.



42. **Pachyotus atilis** (*G. M. Allen*).

The silky fur of this brown bat is not very long, rather light above and decidedly pale beneath. Its flight membranes are of a much darker brown; the wings spread about 11 inches (279 mm.), while the length inclusive of tail is 4.64 inches (118 mm.).

Known hitherto from the Blue Nile, it ranges into the Uele district, probably to the edge of the forest. Only two specimens, however, were taken by us in March at Faradje, where they were shot as they flew about over the bank of the river at dusk. One of them had two large embryos in its uterus. In the male the scrotal sacs occupy a curious position, close together but posterior to the anus.

43. **Pachyotus nigrita nux** *Thomas*.

This is the largest vespertilionid in our collection; it attains a total length of 4.8 inches (122 mm.). The wings, with a spread of 13.8 inches (350 mm.), are as black as the rounded ears and the muzzle. The rather smooth fur is russet above and ochraceous tawny on the lower side.

The stomach contents showed minute remains of insects, and both specimens had each a large fœtus (March). Natives, who were occupied in felling trees to make the necessary clearing for a plantation, claimed to have taken them in a hollow trunk from which many others escaped. This information is undoubtedly correct, inasmuch as these bats show a rather large pad beneath the thumb indicative of climbing upon hard or rough surfaces.

44. **Glauconycteris papilio** (*Thomas*).

The "butterfly bat" is the prettiest bat we met with in the Congo. Of medium size, it measures 4.05 inches (103 mm.) in length, and its wings extend 12 inches (305 mm.). The dry skins of collections can hardly give an idea of the delicate and charming pattern of their wings. Indeed when alive the curious dark veining is admirably set off by the orange hues of the dull velvety background of wing and interfemoral membranes. The tiny rufous or brown body, much lighter below, and the blunt head attract but little attention. The tail takes up about half of the total length. The females average somewhat larger than the males.

Out of ten females collected in March, two had one fœtus each, but another had two young ready to be born. Their breeding season therefore is perhaps restricted to March and April. The bats and their young could then take refuge in the bushes and low trees newly burst into leaf after the

annual fires, which at the beginning of the dry season in December and January had left them perfectly bare.

We found these bats at Faradje during the day hiding in the thatch of abandoned native huts, more than ten huddled in one place, but usually they seem to prefer to conceal themselves between suitable bunches of leaves, as a rule two or three together. Twice we observed in Niangara and Faradje that an overcast sky allowed them to leave their sleeping quarters as early as five o'clock in the evening, when it was still bright daylight. Rather high in the air, sometimes 50 feet from the ground, their ordinary dusky image against the sky gave no hint of their peculiar and strange beauty. They fluttered swiftly, now and then increasing their speed with such spontaneous ease that one hardly noticed the quickened beating of the wings as they gathered their tiny insect prey.

During flight they often utter a curious squeak, as they do, but more angrily, when handled, and like most insectivorous bats open their mouth so wide that in spite of their tiny gape they find no difficulty in biting into the tip of the finger.

We saw these bats only about Niangara, Faradje, and Aba and can state that they are restricted to the more open bush country outside of the equatorial forest.

45. ***Glauconycteris humeralis* sp. nov.**

Text Fig. 7, *A* (p. 448).

Very different in color from the "butterfly bat" are its dark brown congeners of the Ituri forest. The type of *Glauconycteris humeralis* was one of four specimens all captured together in a bush by a native, while the fifth specimen, a gravid female from Avakubi, was found by a native unable to fly because of an injury to its wing. In length this species measures about 3.25 inches (82 mm.), the expanse of its wings being 9.75 inches (248 mm.).

46. ***Glauconycteris alboguttatus* sp. nov.**

Text Fig. 7, *B* (p. 448).

Larger than the preceding, with wings spreading 11 inches, this species nevertheless seems to inhabit the same region. Our specimen was procured by a native. For a representation of the color pattern see Fig. 7, p. 448.

47. ***Miniopterus breyeri vicinior* subsp. nov.**

The fuscous wings are almost matched in color by the fur of the back, that of the lower surface being slightly lighter. The total length is 3.94

inches (100 mm.); tail, 1.89 inches (48 mm.); expanse of wings, 11 inches (280 mm.).

With the exception of a few species of *Pipistrellus*, one may say that the Vespertilionidæ do not rank very high among the bats of the Congo with regard to abundance of individuals, in spite of the considerable number of species. So too, among the many Chiroptera we found living in the rocks near Aba, only one belonged to that family, *Miniopterus breyeri vicinior*. Beyond the fact that they live in colonies in fissures, and that the specimens were procured by smoking them out, little can be said as to their habits.

#### 48. *Miniopterus inflatus* Thomas.

We collected this dull-colored bat at Thysville in the only extensive cave we investigated in the Belgian Congo; it had been taken previously at Efulen, over 500 miles northward. Blackish-brown above, it is somewhat lighter below, chiefly on account of the numerous gray hair-tips. Its total length is 4 inches (102 mm.) and the dark wings have a spread of 11.8 inches (300 mm.). The minute nose when greatly magnified resembles the muzzle



Fig. 23. *Miniopterus inflatus*. Head of male (No. 49334).  $\frac{2}{1}$ .

of a cow in smoothness and in the form of the papillæ, the anterior edge of the lower lip has a hairless pad. Attention may be called to a curious adaptation to their cave life, the folding of their wings when creeping over rocks or when resting. The second phalanges of the third and fourth digits are folded beneath the wing in a peculiar manner (Fig. 24). Their food, according to stomach examinations, consists of rather small insects. They had several interesting forms of parasites (p. 559).

A few miles eastward of Thysville among the many grass-covered hills



lies the famous bat-cave of the region. Fairy tales have made it the lair of a weird leopard that leaves no traces of his victims. The ever-recurrent rumors of plaintive voices heard from within the cave keep most of the natives at a respectful distance. All these people consider bats choice morsels, yet they would never dare disturb the sanctuary granted by their own superstitions to thousands of bats.

No wonder that our native guides, so enthusiastic at first to show us the hills, suddenly lost heart on hearing that the lanterns they carried would enable us to go inside that very cave. In spite of their hesitation we induced them to show us the hill of our queries, and Dr. Bequaert shared our elation when they finally pointed it out just across a gully.

It looked imposing, and was one of the larger hills belonging to a regular chain. Fairly flat-topped like all the others, with stunted bushes and gnarled trees reaching above the half-dry grass, it rose rather steeply some 400 feet above the valley. We noticed high up on its flanks the more barren patches of limestone that marked the fissures through which the bats and perhaps a few owls found access to the cave. The great entrance however at the foot of the hill was completely masked by a conspicuous patch of dark-green vegetation that thrives well in the moist alluvial soil deposited there by annual floods.

At this season, in July, the cave was nearly dry and its opening was a jagged tunnel some 15 feet in height and of equal width. A shallow streamlet ran along its whole length, some 700 yards, and proved by its slow progress that the descent was slight. A precipitous shelf marked the end of

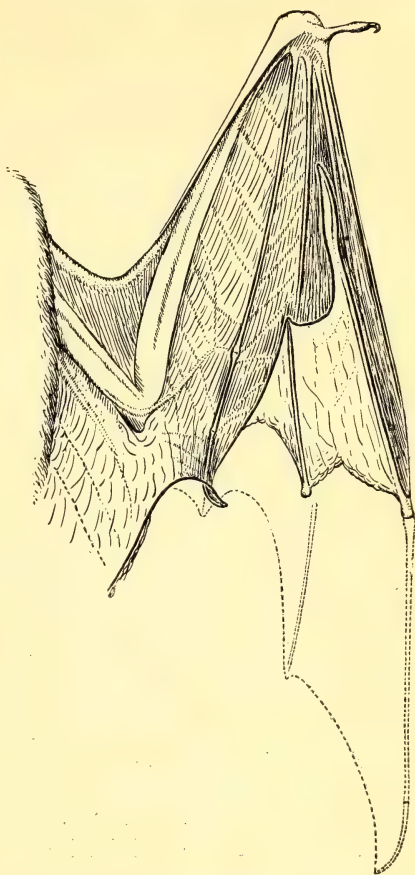


Fig. 24. *Miniopterus inflatus* Thomas. Left wing from below, showing the tip folded. Male, No. 49330.

the accessible part, and the water with but little noise disappeared at once in a chaotic mass of boulders. Sometimes the smooth overhanging walls form large and rugged chambers about 100 feet in height, but everywhere the walls are a dull black. We soon realized that this cave belonged to the bats alone, for there was hardly any room for creatures that could not cling high above its floor. The annual floods would completely close the narrow passages between the obstructing boulders, and inrushing gravel-bearing torrents then scour all the horizontal shelves near the bottom. In spite of the great numbers of bats, only a fine layer of moist guano that exhaled a strong alkaline stench was scattered everywhere, and over it hopped a few pale cave-crickets. We also found a few snails, spiders, and ants, but of species common outside the cave. We had been told of the wonders of this cave, of its remarkable fossils, which proved to be simple erosions, of its great stagnant pools that were however only an inch or two in depth and unsuitable for any aquatic fauna. It was interesting only because of these thousands of bats, even though they all belonged to a single species, *Miniopterus inflatus*.

We had with us two of our old trusted boys, Wawe and Choma-Choma, and proceeded but slowly inside so as to make sure of our way out. Since we were without firearms we wondered how to get the bats; but as the manifold echoes of our voices broke the mystic silence, the cave suddenly became alive. To the great terror of our boys, the "devils" came down upon us. Though the volume of whirring noises was enormous, only a few of the bats encircled our lanterns, like timid scouts who alone dared to inquire into the cause of the unusual disturbance. After catching some with a few lucky strokes of a butterfly net, we were glad to come back again to daylight. Our guides, black messengers of bad omens, cheered up, and we ourselves laughed heartily as we explained to them that according to the white man's superstition we had had bad luck, for we had caught thirteen bats.

#### 49. *Kerivoula cuprosa* Thomas.

At first sight this rather rare species resembles *Pipistrellus nanus* though it is somewhat larger, being 3.55 inches (90 mm.) in length, with a spread of wing of 10.85 inches (250 mm.). Above, the dark-brown frizzled hair has pale-brown tips that give it a peculiar golden sheen, but when looked at from another angle appears as though singed. The somewhat lighter under side has also pale-tipped fur. One of its distinctive characters is the fine growth of hair on the skin of the upper surface of the limbs. The toes and thumb are especially well covered, and a few scattered hairs extend to the end of the tail and along the third digit to the tip of the wing.

They do not seem to frequent native plantations but to live in hollow

branches, perhaps only in the neighborhood of forest brooks. In fact, a female with a young one, four-fifths her size, was taken when felling some saplings to allow a better crossing for our porters. This species evidently is restricted to the West African rain-forest.

#### MOLOSSIDÆ.

##### 50. *Myopterus albatus* (Thomas).

Plate LIII, Fig. 2.

A large, strangely colored molossid, this bat shows well the distinctive features of the rare genus *Myopterus*. With a total length of 5.25 inches (133 mm.) and the expanse of the transparent wings 14.7 inches (374 mm.), it is only slightly smaller than *Mops congicus*. The tail for two-thirds of its length is involved in the interfemoral membrane. The creamy-white under side contrasts markedly with the brown and buff of the upper side, especially in adult specimens, which show the two typical pale buff stripes dividing the brown color of the back into one narrow median and two broader lateral lines.

When alive *Myopterus albatus* has more erect and pointed ears than species of other African genera of Molossidæ, which have them more depressed and expanding laterally. The whole snout is more cylindrical, the chin is nearly hairless, the lips are rough but not vertically wrinkled, the nostrils do not open on distinct hardened pads, but the nose is smooth and rounded. Below it on the upper lip is an area densely covered with so-called "spoon-hairs." Minute hairs of this kind may be seen in the same position in all the molossids we collected, and they are of regular occurrence on the first and fifth toe in this family. In *Myopterus albatus* they are especially large on the upper lip and always turned upward in the direction of the nostrils, the lower ones being hooked, whereas most of the upper ones bear a spatulate tip. Such a unique tactile broom right in front of the mouth should be more effective than ordinary vibrissæ, and this species could well be called the "brush-lipped" bat (Plate LIII, Fig. 2).

The specimens in our collection were taken from a small colony in a hollow tree at Niangara. The natives first secured five females, and the next day caught two more examples, one of which was a male.

##### 51. *Nyctinomus ansorgei* Thomas.

The whole upper side is dark reddish brown of a somewhat singed appearance, as the short hair shows curious light tips. The ventral surface is paler,



nearly grayish towards the abdomen, though the throat, especially in adult males, is very dark brown. The total length is 4.45 inches (113 mm.), about one third of which is occupied by the tail. The wing-spread is 13 inches (331 mm.). The wing, at the base of the first digit, has a smooth pad rather large and well adapted for climbing over the rocks. The males showed a well-developed scrotum close to the base of the penis but there were no pregnant females nor did they have any young.

A single bat was taken from a hollow tree near Faradje, all the others are from Piaga, some fifteen miles east of Faradje. Here these bats had established their abode in a long, narrow crack running vertically into the rock of a lone hill which rises some 200 feet in height above the surrounding bushveldt. A layer of dried dung, over a foot in thickness right below the fissure, indicated at once that we had to do with a long-established colony. Such hills offer favorite roosts for many kinds of insectivorous bats.

Some of the more enterprising natives of the nearest Azande village have by common consent assumed the sole right of making periodical raids upon these bats. Since the only entrance is situated on the lower side of the overhanging rock and quite inaccessible, the natives had lashed several poles together to form a rude ladder. Thus they are enabled to stuff heaps of dry grass into the opening, which is only about half a foot wide. When set afire the large amount of smoke produced suffocates the bats by the hundreds and, according to the tales of natives, basketfuls of delicious fatty "birds" are taken home and consumed as a delicacy.

These bats had not been disturbed the day Chapin climbed up the hill. He could distinctly hear them squeaking as they moved about inside the pitch-dark cleft. Wanting only a few, he fired three shots blindly up into the crevice and secured all the specimens in our collection. This naturally caused a babel of squeaking and whirring noises; but not a single bat tried to fly outside, though to judge from the commotion it seemed certainly no exaggeration to estimate their number as several hundred.

This species has hitherto been known only from Malange in northern Angola, where it was collected by Dr. W. J. Ansorge.

## 52. *Nyctinomus leonis* Thomas.

Similar in size and appearance to *N. ochraceus*, but much paler, nearly whitish, below. Only two examples were secured, one at Medje, the other at Panga, on the Aruwimi, but the details of the latter's capture show that in habits it resembles *N. ochraceus* closely. In a swampy forest a couple of miles back of the village a large tree had been found, four feet in diameter, which was hollow from its base upward to a height of 15 yards, with several openings above, but near the ground with only a small hole at one side.

Two large flying-squirrels (*Anomalurus jacksoni*) had already been chased out of this tree by poking a long stick up into it, but since this method no longer produced any effect, we now stuffed burning sticks and leaves into the aperture. For a long time only a little pale blue smoke leaked out above, nothing stirred, and the refuge seemed deserted. At length, however, the inside of the tree took fire, and dense clouds of thick yellowish smoke began to roll upwards. Suddenly a tiny flying-squirrel (*Idiurus macrotis*) made its appearance at one of the upper openings, but withdrew again into the smoke. Soon we discerned another that had already climbed well out on a limb, where it clung against the bark. Had not the tree been nearly bare of foliage we should never have seen it. The smoke was becoming unbearable; the tenants were forced to make a sortie. Three tiny flying squirrels made good their escape by sailing off to shelter in other trees, but four more were secured, as well as two large flying squirrels and this bat, which clambered out on to the bark, but fortunately did not take wing. The only other inhabitant seemed to be a large gecko (*Hemidactylus*).

The tall hollow trunk made an efficient chimney; after a time its whole interior, with a loud roar, burst into flames, which leaped up out of the openings at the top. The hunt was finished. What impressed us most was the amount of smoking these animals could stand before they would venture out into daylight.

These are the farthest eastern records for the species, which was first discovered at Sierra Leone, and later found in the Kamerun and French Congo.

### 53. *Nyctinomus cisturus* Thomas.

Only 3.75 inches (95 mm.) in length, it is chocolate-brown on its upper side and only slightly grayer on the belly. From the fourth digit outward the dark-colored wing membranes are nearly transparent, and the small band of hair across their base on the lower side is pure white and very conspicuous. Alongside the base of the tail below are scattered white hairs. Associated with them are said to be peculiar glands present only in adult males. The hair back of the interaural band is slightly longer but there is no crest.

At Niangara this typical molossid was brought to us by a native who claimed to have caught it when felling a hollow stump. It was formerly recorded only from Mongalla on the White Nile.

### 54. *Nyctinomus ochraceus*, sp. nov.

The dark rich-brown hair on the upper side, with its silky luster, and the bright orange ventral surface make it a rather conspicuously colored bat,

that can thus be easily distinguished. Some specimens, it is true, are slightly paler, but this is individual variation rather than sexual difference. The wings are dark and measure 10.5 inches (266 mm.) across; the total length is 4 inches (102 mm.).

As is generally the case in colonies of molossid bats, the females were the more numerous, and they seem to have a definite breeding season. Among those selected from over a hundred there were only four males, in contrast with eighteen females, fourteen of which had each a single medium-sized embryo in the right side of the uterus. Their full stomachs showed that they had fed upon winged termites, which had been so finely chewed that they formed only a greasy paste with a few chitinous particles from thorax and limbs. Termite wings, which drop off so easily, are apparently rejected.

They have a plump appearance and like most bats of this genus are rather fatty. Since in equatorial regions most of the larger game and even the birds are lean, the natives in spite of the repellent odor exhaled by these bats have so great an appreciation not only for the meat, but especially for the grease which they furnish, that they frequently destroy entire colonies. Very often these bats live in hollow trunks of trees of enormous size or in the hollow portions of their branches. To reach these strongholds, the natives, who could not think of climbing up without assistance, lash light poles one above the other by passing flexible lianas around the trunk. Thus the ascent presents no further difficulty. In this particular case they stuffed dry leaves and sticks into the only exit, some 50 feet from the ground. Setting them on fire they entrapped all the inhabitants, which after much struggling and squeaking fell to the bottom of the hollow.

Sometimes it happens that a tree catches fire inside, but usually the smoke alone suffocates the unfortunate victims. The natives then cut an opening with their axes near the bottom of the cavity and remove the stupefied and partly burned bats.

Such hollow trees are usually inhabited by only a single species of bat, but very often one or more of the five species of flying-squirrels (*Anomalurus jacksoni*, *A. pusillus*, *A. beecrofti*, *Idiurus zenkeri*, *I. macrotis*) are killed at the same time. Enormous brown roaches also live in the fissures of the decayed wood, and at the bottom of the hole, generally filled with decomposed debris, the natives find very large beetle larvæ, which roasted over the fire are consumed with great delight.

#### 55. *Chærephon frater* sp. nov.

A rather small and pretty mastiff-bat that measures only 3.46 inches (88 mm.) in length, the sharp-pointed transparent wings expanding to 9.7 inches (247 mm.). The chocolate-brown upper side, with a grayish bloom,



differs markedly from the ventral side. A great white patch extends from the breast to the vent and then forward over the wing membrane to the armpit as a narrow band of silky white hair. The white, forming thus a W, is interrupted by the dark sides, which fuse with the white-tipped brown hair of the breast and throat. Though distinguished by its much lighter underside it strangely resembles *Chærephon cristatus*, found 25 miles upstream, in the houses at Boma.

It also shows a tiny crest, noticeable in both sexes, but curiously enough much less pronounced in the six males, where it is represented by only a few short dark hairs, than in several of the females (of which we have 16). The latter have a distinct dense patch of coarse, wavy, brown hair just in the center of the back of the membranous skin connecting the ears. This is contrary to what we find in *Chærephon abæ*, where only the males have a crest, and in *Mops osborni* where it is also better developed in that sex.

One evening at Malela, as we watched the numerous palm-swifts that shot back and forth between the great fronds of the few fan-palms near the shore, we saw a bat flying out from underneath the dense entangled masses of dead leaves. Next day a native climbed up, and though he saw several bats clinging close to the trunk, he killed but one. Here, as in so many other instances, the kindly influence of M. Quiton aided us in the enrichment of our collections, so we were enabled to secure 22 specimens.

*Chærephon frater*, then unknown to science, was found to be the only common bat at Malela, as all our efforts to secure other species proved fruitless. It lived in numbers in that part of the gable of the houses which was generally shut off, clinging in the interstices beside the rafters, several often close together. But as soon as we entered their hiding place they all took wing, making a whirring noise, and many of them sought refuge in the other houses in spite of the bright sunshine. This bat was often observed to fly swiftly between the many narrow lanes of the tall mangrove swamps of that portion of the estuary. Since it seldom frequented the open places over the post, it evidently prefers the wide expanses of water, over the surface of which it skims with great speed; but at times it was seen rather high in the air. The stomach contents show that it feeds on insects without hard integuments.

#### 56. *Chærephon russatus* sp. nov.

Plate LIV.

The warm rufous-brown upper surface of *Chærephon russatus* merges gradually in the lighter, grayer belly. It is only 4 inches (102 mm.) in length, and 11.5 inches (292 mm.) across the outspread wings. In *Mops congicus* it has a perfect counterpart, about one third larger, and very

similar in color. Stranger still, the two species were found as room-mates, and as a matter of fact the smaller individuals were declared by natives to be the young of the larger.

Out of 20 females of *C. russatus* examined in September, six had each one foetus. Both these species are new to science and were taken in the Ituri forest, in the neighborhood of Medje.

Clinging to the rough, decayed surface of the inside of a hollow tree, with their dark wings tucked closely to their plump bodies, these molossid bats look much more like a curiously glistening dark lump of fungus growth than live creatures (Plate LIV).

African molossids generally live together in large numbers, only one species inhabiting the same hollow or cave. As an exception to this rule we once found *Chærophon russatus* and *Mops congicus* forming a large colony in a big hollow tree. Such half-dead giants are often the only reliable witnesses of the height of former forest growth in the neighborhood of villages or in the midst of plantations. They are not considered worth the trouble of felling, as their few stunted branches do not throw the broad shadows that would shut out the sunlight so essential for the successful growth of the one important native staple food, plantains. But as these trees become more and more hollow, many bats attracted by the complete darkness of the sinuous, often labyrinth-like interior find them the most suitable abode in such level forest countries where caves and rocky clefts are rare. They populate them in such numbers that one might speak of hidden bat-cities. From their narrow gates they fly out in even more ghost-like fashion than the bats of temperate climates; because behind the vaporous veil of the damp equatorial atmosphere they disappear instantly. The free-tailed bats indeed are the swiftest in flight, and though several may be seen passing about at one time, each one by itself chases in dexterous swoops the insects it is most fond of, often some two hundred feet from the ground above the dense canopy of the forest, or else lower down about the clearings.

During one of the violent storms that periodically test the stability of such weather-beaten trunks, it happened that the home of an especially large colony not far away from our camp was completely shattered. There we discovered *C. russatus* and *Mops congicus* together. The catastrophe happened in the early afternoon when they all were resting. It seems surprising that in the thundering fall very few bats met their death, but most of them accommodated themselves quickly inside the hollow fragments, from which native children chased them out. Those driven out, when touched, would stop for a moment and lifting their heads would squeak, all the while keeping their mouths wide open and rapidly following the movements of

our hand, they were ready to defend themselves with their sharp teeth. But suddenly they might turn, and tails slightly raised, with the help of their folded wings, they would scamper off swiftly on all fours, only to climb quickly into any of the holes or to flatten themselves against the roughened, decayed surfaces of the broken pieces so as hardly to be seen.

They certainly liked to huddle together in great numbers. Those we kept alive in a box were continually crowding into one corner, squeaking and fighting when separated, until as many as six had settled again over each other. We wondered why those below did not suffocate, yet they seemed to feel no inconvenience.

The two species show hardly any difference in their behavior. The photograph (Plate LIV) indicates clearly the peculiar molossid way of resting. Instead of hanging by the feet, extended to nearly their full length, as all the fruit bats and long-haired insectivorous bats (*e. g.*, *Nycteridae* and *Rhinolophidae*), these short-haired mastiff-bats never hang free, but cling to the surface with both feet and wings. As they can seldom fly directly into the narrow clefts or hollows where they choose to remain during the day they naturally have to creep on all fours for considerable distances. Since they can crawl forward or backward with the same ease, they can enter or back out of the narrowest fissures without any trouble. At the base of the short first digit all molossid bats show a curious hardened pad that assists in this peculiar manner of progression. These pads are more or less developed in different species, and are to be compared with those of *Pipistrellus nanus* (p. 530), but never become such specialized organs as the sucker of the South American genus *Thyroptera*. Those living in the fissures of rocks (*e. g.*, *Nyctinomus ansorgei*) show naturally much larger pads than those habitually frequenting hollow trees, where the surface is softer, such as *Nyctinomus ochraceus*, *Mops congicus*, *Charephon russatus*. So used are they to this mode of creeping that, put on the ground they do not even try to flutter off like other bats, but scurry quickly for the darkest spot in sight. When thrown into the air, however, they fly off easily in spite of the sun, making for any bush or tree and creeping quickly under cover.

When landing on any surface they instantly fold up their wings. The photograph (Plate LIV) reveals well the great assistance they derive from them even in the position of complete rest. As in all other bats, the short first digit of the wing bears a claw, especially sharp in these forms. It can be turned upward, forward, sidewise, and to the rear, in the direction of the other much longer digits that support the flying membranes. Thus they can cling with it to even small roughnesses in any desired position. The toes play an equally interesting rôle on account of the curious structure of their hairs. All these bats when they finally reach their hiding places cling



to the surface with feet drawn in and toes widely spread. The first and fifth digits of all the Molossidæ in our collection show a remarkable growth of bristly hairs of unequal length (Fig. 20, p. 556). Most of the longer ones are recurved, nearly hooked at their tips, and grow on the exterior margin of these two toes and about all the claws. The shorter ones are especially numerous on the lower surface of these two toes, sometimes forming dense rows; most of them show a clearly spatulate tip which on superficial inspec-

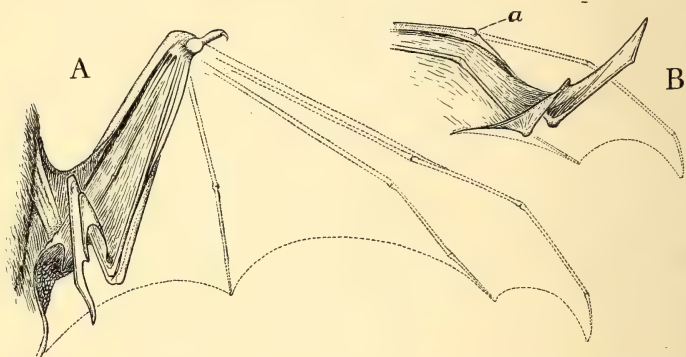


Fig. 25. Wing of *Chærophon russatus*. A. Viewed from below, almost completely folded; extended wing in dotted lines. B. Tip of half-open wing, also from beneath, showing the rotation necessary at *a*, the joint between metacarpal and first phalanx of digit 3, to bring it into position for flight.  $\frac{3}{4}$ .

tion gives the impression that they have been singed. These curious hairs have undoubtedly a tactile function, as one might surmise from seeing the bats moving and spreading their toes. Their tiny sharp claws, guided by these tactile brushes, are able to take advantage more rapidly of even the slightest unevenness in rock or wood to which they cling.

We do not think that the function of these spoon-hairs as a comb is very important, though we realize that the short-haired molossids being generally gregarious and living habitually in the very same places for long periods might naturally be infested by the so-called bat-lice (p. 559), yet as a rule they seem to be free from them. We collected nycteribiids only as we happened to notice them in handling the bats, but while we were in a bat cave near Thysville with Dr. Bequaert, who was especially interested in these parasites, we investigated our bats as quickly as they were caught, and secured as many as five bat-lice from a single vespertilionid, *Miniopterus inflatus*, which lived there by the hundreds. From thirteen specimens Dr. Bequaert, who will later publish a special paper on the Nycteribiidæ, could identify three different bat-lice (p. 559).

On the other hand nycteribiids are probably rarer on such long-haired

forms as seldom settle in colonies but usually change their abode from day to day. Among the fruit-bats, the gregarious roussette (*Eidolon helvum*) (p. 499) is perhaps more troubled by these parasites than any other bat, and they clean or comb themselves much in the same manner as molossids, but their long toes are bare and without a trace of spoon-hairs. Hanging by one foot, bats scratch or comb themselves with the other with perfect ease all over the belly or about the head and can also reach their backs. Should any parasite be caught even momentarily between such spoon-hairs molossids are certainly adroit enough to dispose of it rapidly.

57. **Chærephon** sp. indet.

Though this specimen is still immature, it is already larger than *Chærephon russatus*, which it resembles in every respect save that it has a much more reddish-brown ventral surface.

It was shot at Avakubi as it circled over the Ituri River, preying on insects.

58. **Chærephon (Lophomops) chapini** sp. nov.

Text Fig. 9 (p. 462).

This small free-tailed bat owes its bizarre appearance to the pretty tuft of long silky hair that decorates the top of its head. Just as in *C. cristatus*, this topknot, attached to the posterior surface of the membrane joining the ears, can be either erected conspicuously or laid back almost out of sight by drawing this fold of skin forward or backward. But in the present species it is far more beautiful; not only are the hairs longer, but while their tips are of a whitish color, their basal portions, forming the center of the crest, are of a rich warm brown. The fur of the body is dull-brown above, and light gray-brown below, the wing membranes filmy white. From nose to tip of tail the length is but 3.3 inches (84 mm.). The only two specimens, both males, are from Faradje; and the species, like *C. cristatus*, inhabits an open district. The forest does not seem to be favored by these tufted bats.

Little can be said of the habits of *C. chapini*. Our first specimen was captured by a black servant in a house at the station, but surely they were not of regular occurrence there, as no other could be secured. The second specimen was taken from the crop of the strange, crepuscular bat-catching hawk, *Machærhamphus anderssoni*. Although darkness had not yet completely closed in, this bird had eaten four small bats, representing as many distinct species, three of which were still unknown to science: *Chærephon chapini*, *Allomops faradjius*, *Eptesicus ater* and *Pipistrellus nanus*. In

addition to the foregoing, *Nyctinomus ochraceus* and *Mimetillus moloneyi* have been found in the crops of other individuals of these hawks.

A few words about this remarkable bird of prey may not be out of place here, especially as it seems in so many ways adapted just for the capture of bats. Its unusually large yellow eyes suggest at once its nocturnal habits. By day it seldom appears but becomes extremely active at dusk. Falcon-like it pounces upon even the most rapid fliers among bats, striking them, we believe, with its long talons. Its small sharply hooked, laterally compressed bill may help to kill them, and its wide gape of course can dispose of a dead bat at once (Plate LII, Figs. 2 and 3). From our observations we feel inclined to think that it swallows its prey in full flight; and if not softened by the gastric fluids, such bats may make satisfactory specimens. *Machæramphus anderssoni* is not so rare as generally believed, ranging through tropical Africa to Madagascar. We have seen it all across the Belgian Congo from Boma to Faradje, in open and forest country alike. In color it is brownish-black with faint gray bands on the tail, and a little white on the nape, sides of throat and abdomen. In its general proportions it suggests a peregrine falcon, and though ornithologists have often associated this genus with *Buteo* or *Pernis*, it bears no external resemblance to either of them (Plate LV). Tall bare trees are preferred as perches, but most of the evening seems to be spent on the wing, skimming over the rivers, shooting about the clearings or over the bush country in pursuit of flying prey, or perhaps even coming to raid a colony of nesting weaver-birds.

To say that it preys exclusively on Chiroptera would not be true. Of the nine stomachs examined two were empty, while the others contained a total of eleven bats and ten birds. Half of the latter however were taken from a single hawk. They were bank swallows (*Riparia riparia*), captured as they were flying down the Ituri River to roost in the evening, and swallowed whole, head first. So bats are really the more usual food.

In Africa as elsewhere, stomach examinations of other birds of prey, either nocturnal or diurnal, very rarely disclose bats; indeed they seem to be caught only by accident.

59. **Chærephon (Lophomops) cristatus** sp. nov.

Text Fig. 10 (p. 464).

A small dark-brown bat nearly 3.5 inches (87 mm.) in length, with white-tipped hair below, and pure-white hair along the sides of the body on the inner edges of the wing membranes. The latter are thin and white, but the most striking feature of all is the tuft of brown hair on the posterior surface of the interaural membrane. This topknot is very like that of *C.*



*chapini*, but the hairs are shorter, and more of one color throughout. Behind it is a bare space, covered of course when the long hair is laid back. Our four specimens being all males, we cannot say whether the females differ, like those of *C. abæ*, in lacking the tuft.

In some of the houses at Boma, including that kindly placed at our disposal by the Belgian authorities, these queer little bats were not uncommon, spending the day singly or at most in twos, in crevices beneath the roofs of verandas, especially where they joined the main concrete wall of the house. They crawled about actively, and were by no means easy to secure. One was captured with a butterfly net as it flew about in a room at night.

60. **Chærephon (Lophomops) abæ** sp. nov.

Text Fig. 11 (p. 465).

At the first glance this dull-colored, medium-sized wrinkle-lipped bat seems to possess no great peculiarities, but closer investigation shows a few points of interest. The remarkable crest of the male is practically hidden, since it grows on the back of a nearly triangular flap filling the gap between the anterior bases of the ears. This membrane is usually turned backward and in the crestless female covers a hairless spot (Text Fig. 11, p. 565). In the male however it can undoubtedly be moved forward so as to show to full advantage the peculiar adornment, a snuff-brown topknot composed of stiff hairs, the longest of which reach 7 mm. in length and radiate from a common center.

This bat attains a total length of 4 inches (102 mm.) and a wing-spread of 12 inches (305 mm.); the upper side is uniform sepia. On the ventral surface the more or less distinct median line and the narrow band on the base of the wing membranes are pure white and rather conspicuous, especially as the rest of the fur is either dark or grayish brown.

Four of these bats were taken in the neighborhood of Faradje in February and March from a hollow tree. The twenty-five others, however, are from rocky clefts of a hill near Aba. They lived in numbers in the dark fissures, their presence being at once betrayed by the curious musty smell. Smoking out the bats by burning grass proved in this case unsuccessful, since the smoke was carried away in another direction. We succeeded better by fastening a leafy branch to a pole and swishing it back and forth between the rocks. A few of the bats fluttered to the ground slightly injured but rapidly crept under cover. More than a hundred were flying to and fro in the dim light of the cleft, and several were caught while dodging about our heads, but none even attempted to fly out into the open or to hide in another cranny. Each bat seemed to be intent on returning to its habitual

resting-place. This was apparent, as there were many crevices, and when we stirred them from their refuge they would shoot out, but returned at once to the very same fissure as soon as we stopped annoying them.

It is rather surprising that only two males were found among the thirty specimens of this collection and among the many others caught by natives at the same time. This new species is probably restricted to the open country outside the rain-forests.

#### 61. *Mops midas* (Sundevall).

All the specimens were collected at Faradje during March, when the water of the river was lowest. In fact these bats were only seen during a short period. One of the largest of all the wrinkle-lipped bats, it measures 5.3 inches (135 mm.) in length, with the dark wings spreading about 18.5 (469 mm.). Its colors are rather indistinct; the white tips of the brown hair on the back give a peculiar silky bloom, which predominates on the much lighter ventral side. Its ears are very broad and are joined across the forehead by a membrane, but there is no trace of a crest.

During the latter part of the dry season, every evening about dusk, a dozen or so of these fast fliers appeared some 50 or 100 feet above the Dungu River and over the open place of the post. Their favorite sport was to dodge and dive after small hard-shelled Coleoptera, which were then common. We greatly admired their speed, but their success and cleverness in catching insects and the rapidity with which they masticated these tiny beetles in full flight was proved through the microscopical evidence of the stomach contents from specimens shot on the wing.

There are no rocky cliffs in the neighborhood of Faradje, and it is probable that *Mops midas* has its abode in the hollows of large trees along the river. This would be in accordance with Glover M. Allen's remarks. Its known range would prove it a species characteristic of the more open country, since it is recorded from Faradje in the northeastern Uele, across the White Nile to Fazogli on the Abyssinian frontier, a distance of about 600 miles.

#### 62. *Mops congicus* sp. nov.

##### Plate LV.

One of the largest of its genus, measuring 5.5 inches (140 mm.) in length, with a wing spread of 16.5 inches (420 mm.). Its color is very similar to that of *Chærophon russatus* but darker. Together with that species it was found living in a hollow tree near Medje, as described on page 547 ff. Five females out of twelve had each one large embryo (in September).

63. **Mops niangaræ** sp. nov.

Compared with *Mops midas*, which it nearly equals in size, this species shows very definite external characteristics. Its relatively small ears do not join across the forehead; but it can boast of a crown that starts from the short-haired nape and, becoming gradually longer, stops abruptly where the interaural membrane would be in related species, some of which, as *Chærephon* (*Lophomops*) *chapini*, bear an erectile crest on the back of this movable skin (p. 462).

The upper side is hazel-brown, the under side buffy brownish with a yellowish tinge on the breast and on the lower side of the neck. It attains a length of 4.9 inches (125 mm.), the dark wings have an expanse of 16.8 inches (426 mm.).

It is one of the many species that live in hollow trees and probably will be found to occur elsewhere in the more open country of the northern Uele.

64. **Mops trevori** sp. nov.

Plate XLVIII, Fig. 2.

At Faradje in September, half a dozen of these bats flew back and forth so rapidly that we thought shooting one in the dim moonlight more difficult than securing some of the fast-flying swifts and almost impossible. But challenged thus, Chapin brought down one which has proved to be new to science. Only a little smaller than *Mops midas*, it has a length of 4.15 inches (105 mm.) with a wing-spread of 15.1 inches (384 mm.). Above it is chestnut-brown with a distinct bloom; below a light grayish brown tint is predominant, with white hairs especially numerous on throat and breast. Behind the aural membrane it has a crest of coarse, slightly curved hair growing in bunches, but the surrounding ordinary hair is also considerably lengthened. Its stomach contents showed that it fed on good-sized Coleoptera. It also had a very large embryo.

65. **Mops** (**Allomops**) **osborni** sp. nov.

Text Figs. 12-14 (pp. 470 ff.) and 26.

Between the species of *Molossidæ* with a large tuft of hair on the back of the interaural membrane, like *Chærephon* (*Lophomops*) *chapini*, and those that lack it completely, there are several intermediate forms, including the present, where there is a distinct but short dark brown tuft more



pronounced in the male (Fig. 14). The hairs moreover are here gathered into many little bunches, whereas in *C. chapini* they grow singly.

*Mops osborni* is larger than the other crested representatives of the family; total length 4.4 inches (111 mm.); tail 1.5 inches (38 mm.); expanse of wings 13.4 inches (340 mm.). Its colors are dull, the flight membranes grayish-brown, the fur of the upper side hair-brown with a sprinkling of gray hairs, the middle of the belly grayish-white, the rest of the lower side having the hair brown with grayish tips. The most important character is internal: a very high sagittal crest on the skull of the male.

Bats in the Congo, however abundant, seldom trouble one's sleep, for

those that frequent dwellings are generally small and quiet. In all Africa of course there are none that suck blood like the vampires (*Desmodontidae*) of South America. In the Upper Congo even European architecture becomes decidedly simple. Aeration being a prime requisite there is often no ceiling below the roof of grass or *Phrynium* leaves; the whole interior is open. Occasionally such a house when closed for a long period becomes the domicile of a flock of bats; but open the windows wide, admit the light and air, and they depart for good.

More advanced methods of building, however, often prevail in the more accessible parts of the colony, and these dwellings with their many

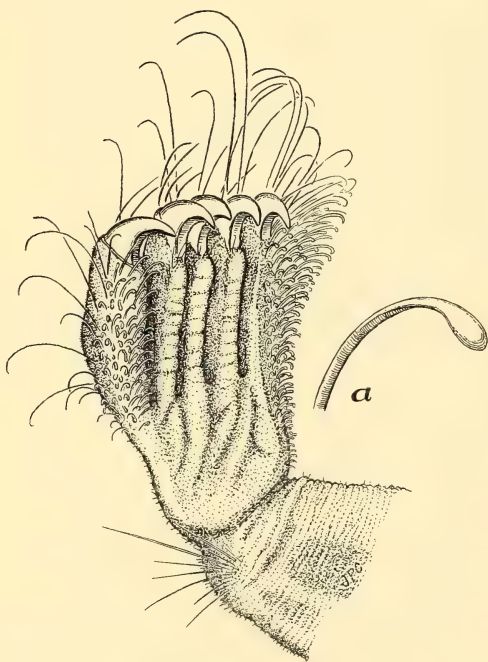


Fig. 26. *Mops (Allomops) osborni*, sp. nov. Right foot (type), from below, to show spoon hairs on first and fifth digits ( $\frac{1}{2}$ ). a, spoon hair enlarged ( $\frac{2}{1}$ ).

remote, dark, or unused portions are frequently chosen as a congenial refuge by Chiroptera. A small house, for instance, in which we lodged at Kinshasa, built most comfortably of wood and sheet metal, was provided with a double roof, the space between being ventilated through holes under the eaves, which served at the same time as doorways for a large community of molossid bats. Occasional scufflings and squeaks betrayed their retreat, and all

the rooms had that peculiar smell noticed beneath the hill at Piaga, where an old-established colony of *Nyctinomus ansorgei* occupied a narrow vertical cleft.

Under ordinary conditions it would have been difficult to obtain any specimens; but efforts were being made to dislodge them, by removing sections of the roof; and one day as I stood on the porch, down tumbled two bats. Sprawling on the ground, they were seized before they could climb anywhere to take wing, though they protested vigorously with their sharp teeth. Fortunately they proved to be male and female of a species new to science, *Mops osborni*.

66. **Mops (*Allomops*) *occipitalis* sp. nov.**

Text Fig. 15 (p. 475).

When alive and moving this bat recalls at first *Nyctinomus ochraceus*, as they both have, on the upper side at least, the same dark, rich brown gloss due to their peculiar smooth and soft appearance. But in *Mops (Allomops) occipitalis* the short hair on the back is restricted to a narrow tract. Where this stops near the base of the hind limbs it ends on either side in a few long hairs, as in many other bats of this genus. Back of the membranous skin uniting the ears the fur is also distinctly longer but forms no crest. Though the flanks are nearly black, the belly is much lighter, either reddish- or buffy-brown. The upper lips are only slightly wrinkled and bear very minute upturned bristles and spoon-hairs. Of medium size, it measures but 4 inches (101 mm.) in length, the dark wings spreading about 10.7 inches (272 mm.).

It lives in hollow trees, and since it was collected only at Medje and Avakubi it may be considered typical of the forest region. The males are exceptionally well represented by seven specimens, whereas among other series of this family females always predominate.

67. **Mops (*Allomops*) *faradjius* sp. nov.**

A medium-sized wrinkle-lipped bat of 4.25 inches (108 mm.) in length with the expanse of its dark wings about 12 inches (305 mm.). Since the dark-brown upper side is tipped with gray, it is not so hoary in appearance as the white-tipped back of the larger *Mops midas*. As in *Mops (Allomops) occipitalis* the hair, short on the nape, becomes somewhat longer before reaching the membranous skin uniting the ears, but there is no real crest. The dark sides of the neck blend into the nearly white ventral surface,

though the sides are strongly suffused with gray. The narrow band on the under side of the wing membrane near its inner edge is also white.

Birds of prey sometimes give indirect information to naturalists as to the smaller fauna of a region. The examination of owl pellets, for instance, has often revealed skulls or portions of rodents or small insectivores not previously known to occur there. Few however can claim to have killed a hawk and taken out of its crop, in good condition, four species of bats, three of which were new to science. Yet such was the luck of Chapin at Faradje when he bagged one of the interesting bat-catching hawks, *Machæ-rhampus anderssoni* (p. 551). Several days previously he had noticed this hawk, but thinking first of an owl, since scarcely any other bird of prey could be active at so late an hour, he was surprised later to recognize this crepuscular hawk. Flying up and down the Dungu River it collected its victims from among the bats that kept close to the surface of the water. *Mops (Allomops) faradjius* is one of the bats thus discovered and this specimen remains unique, as no other could be secured. We already knew of this hawk and its habits but confess that we little expected thus to be aided in securing species still unknown.

68. **Mops (Allomops) nanulus** sp. nov.

Among the nineteen species of molossids we collected, this is by far the smallest. It attains only a length of 3.1 inches (78 mm.), the wing-spread of the dark though slightly transparent wings is 8.75 inches (222 mm.). The general color is dark or rufous brown above, but the under side is much lighter, the neck and a median tract of the belly being usually grayish buff.

Several evenings before their capture these tiny bats were observed to alight, as it seemed, in a cluster of epiphytic ferns (*Asplenium*) growing high up on a trunk; but a closer investigation by daylight proved that these plants only concealed the entrance to a cavity. Some burning splinters of wood were pushed down into the narrow entrance, but our efforts to smoke them out proved a complete failure. Before darkness set in some of these little bats were seen to fly out again from the hole in the tree. They evidently did not hunt in the neighborhood since they were not noticed again. We decided to have a hole cut at the base of the cavity, but though two men chopped away during the better part of the day, only towards evening did the hollow portion become accessible. Two bats managed to escape quickly and the natives, discouraged, gave up the task. We asked them however to try fire again before leaving, and were soon gratified to secure seven specimens, which have proved to be of a species previously unknown to science.



## REMARKS ON PARASITES OF AFRICAN BATS.

In describing the life-histories of African bats it would be a mistake to pass over in silence their interesting insect parasites, especially as these are so apt to be neglected by the mammalogist, in spite of their evident ecological interest. We feel justified therefore in adding a few notes of a general character on this subject, largely provided by Dr. Joseph Bequaert, who speaks from personal experience in the Congo.

Among the various parasites collected on bats by the Congo Expedition, the most curious in appearance are probably the Nycteribiidæ, often called in English bat-lice or bat-ticks. They are however true Diptera, though wingless, pupiparous, blood-sucking parasites. In the adult stage they rarely leave their host.

The following species were collected:

*Tripselia fryeri* Scott. = *conecula* f. on *Saccolaimus peli*.

*Cyclopodia greeffi* Karsch. . . . . on *Eidolon helvum*.

*Penicillidia senegalensis* Gervais. . . . . on *Hipposideros caffer centralis*

*Penicillidia fulvida* Bigot. . . . . on *Miniopterus inflatus*.

*Listropoda schmidlii* Schin. . . . . on " "

The largest of these parasitic flies is *Cyclopodia greeffi* Karsch, which may attain a length of 3 to 4 mm. Its life-history has recently been studied by J. Rodhain and J. Bequaert.<sup>1</sup> It is so common in the Belgian Congo that we rarely found specimens of *Eidolon helvum* without one or more of these parasites. When the host is handled they attract attention by quickly scurrying across the fur, and their spider-like form then becomes noticeable as they try dexterously to conceal themselves somewhere else in the fur with their long legs armed with curved claws. Even after the death of their host, which may have been carried along for hours, or even preserved in alcohol, a few nycteribiids may still be found clinging to the hair. According to Rodhain and Bequaert's observations this parasitic fly lays no eggs, but the young develops inside the body of the female. When the larva is full grown, the pregnant female fly leaves the bat and deposits its larva on some object near the sleeping-place of the host (wood, rocks, leaves, etc.). This larva changes directly into a pupa, and after 12 to 16 days the adult emerges in a wingless state; it has then to search for a new host or otherwise perishes rapidly.

The other nycteribiids probably have similar habits, although very little is known on that subject.

A very interesting winged parasitic fly, *Brachytarsina flavipennis* Macquart, was found on *Miniopterus inflatus*; it belongs to the Streblidæ, a

<sup>1</sup> Observations sur la biologie de *Cyclopodia greeffii* Karsch. Bull. Soc. Zool. de France, XL, 1916, pp. 248-262.

family closely related to the Nycteribiidæ. But little is known of their reproductive habits, though it is believed that they are also pupiparous.

Buried in the skin of bats are sometimes found maggot-like parasites, of a curious flask-shape, which are really adult flies. They have been described under the generic name *Ascodipteron*, and were even separated as a distinct family, the Ascodipteridæ. Recently it has been proved that *Ascodipteron* is only a stage in the adult life of a streblid. On emerging from the pupa the fly has legs, wings, and a large proboscis; the females however soon pierce the skin of a bat and bury themselves deeply within, at the same time losing legs and wings and altering the rest of their external form. These curious insects are pupiparous (or better, larviparous) like the Nycteribiidæ; the orifice through which the adult larva is released opens through the skin of the bat. Several species of *Ascodipteron* have been described,<sup>1</sup> and they are curious examples, in their life-history, of what is called "postimaginal development," the changing of the form and the tissues after the last molt (Dr. J. Bequaert). The integuments in which *Ascodipteron* is usually found are at the base of the ear and on the wing; we found them on *Hipposideros caffer centralis* as well as on one or two other bats from caves at Aba.

The two bugs found on *Pipistrellus musciculus* (p. 553) belong to the family Cimicidæ, the same that includes the common bed-bug. Several genera live as parasites on bats, but these particular specimens have not yet been identified.

#### EXPLANATION OF PLATES XLIV-LV.

##### PLATE XLIV (in color).

##### Heads of males.

- Fig. 1. *Epomophorus anurus* Heuglin.  $\frac{3}{4}$ .  
 Fig. 2. *Epomops franqueti franqueti* (Tomes).  $\frac{3}{4}$ .  
 Fig. 3. *Eidolon helvum* (Kerr).  $\frac{3}{4}$ .  
 Fig. 4. *Hypsignathus monstrosus* H. Allen.  $\frac{3}{4}$ .

Sketched from freshly killed specimens by J. P. Chapin.

##### PLATE XLV.

Fig. 1. *Epomops franqueti franqueti* (Tomes). Head of adult male, No. 49196, Niapu, December, 1913.

Fig. 2. *Epomops franqueti franqueti* (Tomes). Head of a very young female, No. 48718, Medje, Sept. 12, 1910.

This and the following plates from photographs by H. Lang.

<sup>1</sup> For a very complete account see F. Muir, Bulletin of the Museum of Comparative Zoölogy, LIV, 1912, p. 351.

## PLATE XLVI.

*Epomophorus anurus* Heuglin. Female, No. 48749, Faradje, Dec. 1, 1912.

## PLATE XLVII.

*Epomophorus anurus* Heuglin. Female, No. 48749.

## PLATE XLVIII.

Fig. 1. *Taphozous mauritanus* Geoffroy. Female, No. 48798, Faradje.

Fig. 2. *Mops trevori* sp. nov. Female, No. 49250, Faradje, September, 1912.

## PLATE XLIX.

*Saccolaimus peli* (Temminck). Female, No. 48768, Niangara, May 27, 1913.  
Two views of head.

## PLATE L.

*Lavia frons affinis* Andersen and Wroughton. Female, No. 49072, Faradje, April 23, 1911. Front and side views of head.

## PLATE LI.

Fig. 1. *Hipposideros gigas niangarae* subsp. nov. Female, No. 49103, Niangara, May 30, 1913. Front view of head.

Fig. 2. *Rhinolophus axillaris* sp. nov. Male, No. 49132, Aba, December 17, 1911.

## PLATE LII.

Fig. 1. *Hipposideros caffer centralis* Anderson, male, No. 49110, Leopoldville, July 9, 1909.

Fig. 2. Head of bat-catching hawk, *Machærhamphus anderssoni*, Field No. 4468, male, Faradje, Jan. 12, 1913. About  $\frac{1}{2}$ .

Fig. 3. Outline of bill, from above, same specimen.

## PLATE LIII.

Fig. 1. Head of *Chærephon* (*Lophomops*) *cristatus* sp. nov. Male, Boma, June 15, 1915.  $\frac{2}{3}$ .

Fig. 2. Head of *Myopterus albus* Thomas. Female, No. 49228, Niangara, Dec. 27, 1910. Note the dense patch of spoon-hairs on upper lip.  $\frac{2}{3}$ .

## PLATE LIV.

Photograph of three specimens of *Mops congicus* (at left), and of four specimens of *Chærephon russatus* (three at right and one above the middle), showing position and appearance when suspended at rest.

## PLATE LV.

Bat-catching hawk (*Machærhamphus anderssoni*), pursuing a molossid bat (*Mops faradjius*), the largest species which was found in its crop.  $\frac{1}{6}$ .



## TEXT FIGURES.

Map of the Congo and Lake Region of Africa, showing all the localities where bats were collected by the Congo Expedition, as well as others mentioned in the present paper. The limits of the West African rain-forest are indicated by a broken line . . . . . p. 415

Fig. 1. Outline drawings showing how the ear was measured by the collectors. *A*, *Saccolaimus peli* ( $\frac{1}{4}$ ); *B*, *Eidolon helvum* ( $\frac{2}{3}$ ) . . . . . p. 407

Fig. 2. *Hypsignathus monstrosus*. Direct front view of head, adult male, from a freshly killed specimen.  $\frac{1}{4}$  . . . . . p. 419

Fig. 3. *Nycteris awakubia*. Head, from field sketch of type, No. 49403, male.  $\frac{4}{3}$  . . . . . p. 426

Fig. 4. *Hipposideros langi*. Head of adult male (No. 49391), showing nose-leaves and frontal sac.  $\frac{2}{1}$  . . . . . p. 435

Fig. 5. *Hipposideros langi*. Pubic region of female (No. 49389).  $\frac{1}{4}$  . p. 436

Fig. 6. *Hipposideros langi* sp. nov. Pubic region of male (No. 49391). *A*, anal sac invaginated; *B*, anal sac everted.  $\frac{1}{4}$  . . . . . p. 437

Fig. 7. Sketches of (*A*) *Glauconycteris humeralis* sp. nov., male (No. 49315), and (*B*) *G. alboguttatus* sp. nov., type, female (No. 49317), to show white markings of shoulders and back.  $\frac{1}{4}$  . . . . . p. 448

Fig. 8. *Kerivoula cuprosa* Thomas. Skull of adult female (No. 49336).  $\frac{3}{4}$ . p. 452

Fig. 9. *Chærephon (Lophomops) chapini* sp. nov. Adult male (type, No. 48841). *A*, side view of head, crest erect; *B*, view of crown, crest erect; *C*, same view, crest laid back. All  $\frac{3}{2}$  . . . . . p. 462

Fig. 10. *Chærephon (Lophomops) cristatus* sp. nov. Adult male (No. 49259). *A*, crest erect; *B*, crest laid back. All  $\frac{3}{2}$  . . . . . p. 464

Fig. 11. *Chærephon (Lophomops) abæ* sp. nov. *A*, crown view of head, male; *B*, crown of head, female.  $\frac{3}{2}$  . . . . . p. 465

Fig. 12. *Mops (Allomops) osborni* sp. nov. Skull of type, adult male, No. 49230.  $\frac{2}{1}$  . . . . . p. 470

Fig. 13. *Mops (Allomops) osborni* sp. nov. Skull of adult female, No. 49244.  $\frac{2}{1}$  . . . . . p. 471

Fig. 14. *Mops (Allomops) osborni* sp. nov. Crown of male type, to show the small crest on back of frontal membrane.  $\frac{3}{2}$  . . . . . p. 473

Fig. 15. *Mops (Allomops) occipitalis* sp. nov. Skull of adult male type (No. 48851).  $\frac{2}{1}$  . . . . . p. 475

Fig. 16. *Hypsignathus monstrosus*. Tongue of adult male (No. 48657), viewed from above.  $\frac{2}{4}$ . Characteristic form in life, when extended. *con.*, conical; *cv.*, circumvallate; *fil.*, filiform; *fo.*, foliaceous; *trid.*, tridentate papillæ. . . . . p. 485

Fig. 17. Interfemoral membranes. *A*. Rhinopomidæ (*Rhinopoma microphyl-lum*), from beneath; *B*. Emballonuridæ (*Taphozous mauritanus*), from above; *C*. Nycteridæ (*Nycteris arge*), from below; *D*. Molossidæ (*Nyctinomus ansorgei*), from above. All  $\frac{3}{4}$ . For interfemoral membrane of Megadermidæ, see Fig. 22; of Rhinolophidæ, Figs. 5 and 6; of Vespertilionidæ, Figs. 7 and 22. . . . . p. 495

Fig. 18. *Hypsignathus monstrosus*. Head of adult male (No. 48657). The heavy broken line indicates extent of cheek-pouch.  $\frac{3}{4}$  . . . . . p. 503

Fig. 19. *Hypsignathus monstrosus*. Adult male (No. 48657). Dissection from ventral side, showing pharyngeal sacs, hyoid bones, larynx, and general arrangement of viscera. *cric.*, cricoid cartilage of the larynx; *crico-th.*, crico-thyroid muscle; *d. 1, 2, 3, 4, 5*, first to fifth digits; *genio-hy.*, genio-hyoid muscle; *hyo-gl.*, hyoglossus muscle; *mylo-hy.*, mylo-hyoid muscle; *obl. ext.*, external oblique muscle of the abdomen; *obl. int.*, internal oblique muscle; *occ. poll.*, occipito-pollicalis muscle; *or. ph. s.*, orifice of pharyngeal sac, communicating with nasopharynx; *pect. maj.*, pectoralis major; *pect. qu.*, pectoralis quartus; *phar. sac*, left pharyngeal sac; *st. hy.*, sterno-hyoid muscle; *st. mast.*, sterno-mastoid muscle; *thyr.*, thyroid cartilage of larynx.  $\frac{2}{3}$  . . . . . p. 506

Fig. 20. *Hypsignathus monstrosus*. Sagittal section of adult male (No. 48655), showing pharynx, vocal organs, and viscera.  $\frac{2}{3}$  . . . . . p. 507

Fig. 21. *Saccolaimus peli*. Wing from above, to show folding of the tip (wing with tip extended shown by dotted line).  $\frac{1}{2}$  . . . . . p. 515

Fig. 22. A. *Mimetillus moloneyi*.  $\frac{1}{2}$ . B. *Lavia frons affinis*.  $\frac{2}{5}$ . In these two figures the length of head and body is the same, and the extreme difference in relative wing-area is clearly shown . . . . . p. 537

Fig. 23. *Miniopterus inflatus*. Head of male (No. 49334).  $\frac{2}{1}$  . . . . . p. 540

Fig. 24. *Miniopterus inflatus* Thomas. Left wing from below, showing the tip folded. Male, No. 49330.  $\frac{4}{3}$  . . . . . p. 541

Fig. 25. *Chærephon russatus* sp. nov., to show folding of the tip of the wing.  $\frac{3}{4}$ . . . . . p. 550

Fig. 26. *Mops (Allomops) osborni*, sp. nov. Right foot, from below, to show hairs on first and fifth digits. ( $\frac{4}{1}$ ). a, a spoon-hair enlarged. ( $\frac{24}{1}$ ) . . . . . p. 556







Fig. 1. *EPOMOPS FRANQUETI FRANQUETI*, Adult Male.  
Fig. 2.       "       "       "       Young Female.





EPOMOPHORUS ANURUS.







EPOMOPHORUS ANURUS.

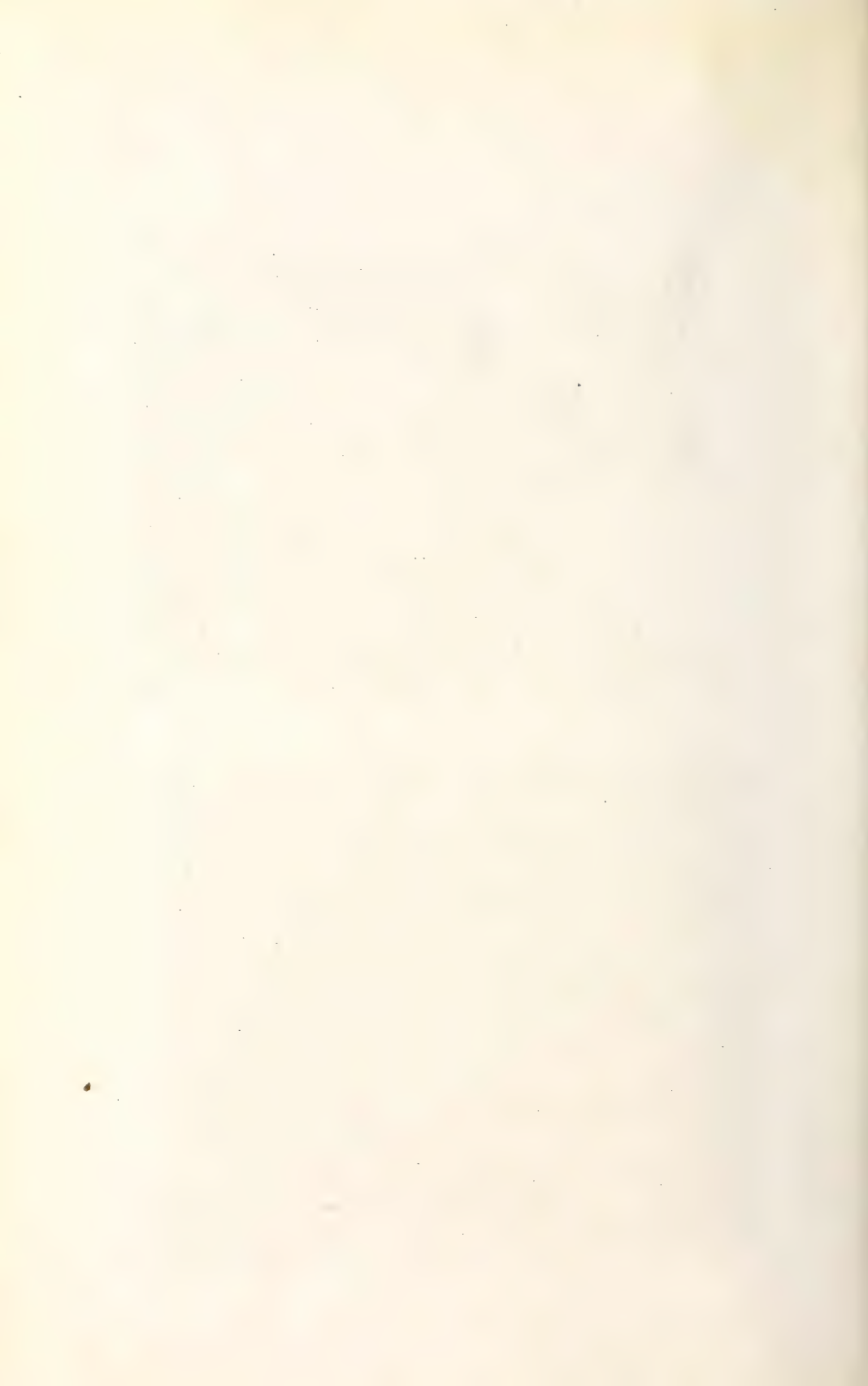






Fig. 1. TAPHOZOUS MAURITIANUS.  
Fig. 2. MOPS TREVORI.





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Fig. 1. *HIPPOSIDEROS GIGAS NIANGARÆ*.

Fig. 2. *RHINOLOPHUS AXILLARIS*.



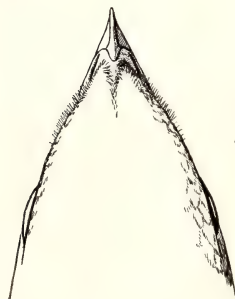




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Fig. 1. HIPPOSIDEROS CAFFER CENTRALIS.

Fig. 2. MACHÆRHAMPHUS ANDERSSONI, Head.

Fig. 3. " " Bill, from above.







SACCOLAIMUS PELI.





LAVIA FRONS AFFINIS.





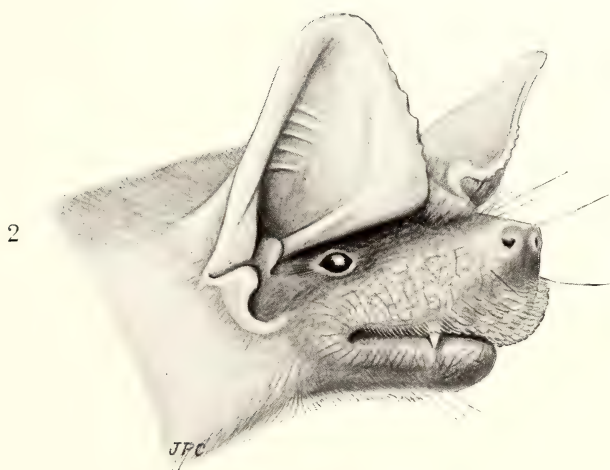


Fig. 1. CHÆREPHON (LOPHOMOPS) CRISTATUS.

Fig. 2. MYOTERUS ALBATUS.







MOPS CONGICUS AND CHEREPHON RUSSATUS.





MACHÆRHAMPHUS ANDERSSONI PURSUING MOPS FARADIUS.



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